Problem Based Learning for Sustainability and Sustainable Cities

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INTRODUCTION

Dear Reader,

Problem Based Learning (PBL) has been stressed as a pedagogical approach, which is suited for engaging students actively in addressing complex real life problems. Taking into consideration the complexity and urgency of the sustainability challenge, PBL have gained increasing attention in education for sustainability.

This special issue is dedicated to the relationship between PBL and Sustainability and includes perspectives and proposals on how to engage students in interdisciplinary educational activities for sustainability with specific focus on PBL research and experiences related to sustainable cities. The research papers and cases will illustrate how PBL as a pedagogical approach can support students engagement and learning to create change on a system level, and also how the interdisciplinary and participatory approaches in urban planning can inspire PBL and especially the problem analysis.

The idea for this special issue came from participants of the Project "Citylab - Engaging Students with Sustainable Cities in Latin-America", co-funded by the Erasmus+ Programme of the European Union (www.citylab-la.eu). The aim of this project was to enhance the quality of Higher Education Institutions in Latin America by increasing their capacity to do Problem Based Learning. The main effort was to increase active, integrated and constructive learning

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methods, assuming a student centered approach, emphasizing on learning to learn and learning by doing, and breaking with traditional teaching methods such as ex-cathedra lectures.

In order to introduce and spread PBL, the partners (12 Latin American and 5 European) worked on specific problems through interdisciplinary approaches, with the support of campus teams represented by pools of teaching staff, administrative staff and policy makers from the different faculties. The partners worked on typical urban problems, related to architecture, urban planning, conservation, energy and climate change, poverty and crime, employment, water management and others similar challenges, which are in general complex, and wicked problems in need of an interdisciplinary approach. Moreover, the selection of urban problems, and the interdisciplinary approach, have provided the opportunity to strengthen the relation between universities and external actors such as urban governments and community associations.

At the end of the project, the Citylab LA project consortium organized a final conference "PBL for Sustainable Cities" in Bogotá, Colombia. This conference had several aims: to disseminate insights and stimulate academic discussion on problem based teaching methods, to present the work of the students in the PBL modules, to present the results of a students' competition after the selection operated by an interdisciplinary jury involving academics and professionals. Then, the conference aimed to involve not only the partners of the Citylab LA project, but also a broad range of teachers in Europe and Latin America to share ideas and experiences on problem based learning.

This academic conference was characterised by a wide range of inspiring lectures, discussions and networking opportunities with experts in the field of Problem Based Learning, researchers and key actors in Sustainable Cities. It has been an important opportunity to share Problem Based Learning research and experiences related to the sustainable development of cities with international colleagues who are actively involved in innovative teaching methods and sustainable cities.

This special issue presents selected and developed papers from this academic conference to further disseminate Problem Based Learning research and experiences relate to the Citylab LA project. In this way, this special issue is targeted to an audience, who are actively involved in PBL and interested in the dialectic relationship between PBL and education for sustainability.

The issue contains *two research papers* and six cases all related to PBL and Sustainable Cities representing a variety of different synergies (see the following table for overview).

Author country	Keywords	Type of publication
Belgium, Colombia, France and Denmark	Cross-university experiences, management of change	Research paper
Belgium and Denmark	World Café technique, qualitative insights	Research paper
Venezuela	Design Studio, Architecture and Urban planning programme	Case
Venezuela	Urban design Course, PBL implementation in workshop	Case
Argentina	Progressive PBL implementation in interdisciplinary urban areas	Case
Italy	Crowd mapping, use of ICT, community engaged learning	Case
Argentina	PBL implementation in urban planning workshop	Case
Mexico	PBL implementation across programs, interdisciplinarity	Case

The first paper is written by seven authors from Belgium, Colombia, France and Denmark and presents cross-institutional research results from the City-Lab project (Coppens, Pineda, Henao, Rybels, Samoilovich, Jonghe, & Camacho). The purpose of the paper is to investigate challenges and opportunities during the implementation of problem based learning in 12 Latin American universities based on the experience of the Citylab LA project. The authors as well as external partners monitored the development in the project and methods includes face-to-face meetings, surveys and focus group interviews. The authors conclude that critical factors were related to the role of the project leader in the organisation, the flexibility of the implementation and cultural differences. Furthermore, the results of the survey showed that the teachers believed that the didactic methods of their Citylab modules significantly contributed to the stimulation of critical thinking and complex problem solving. Further diffusion of PBL on the institutions depended critically on creating support from the top academic administration of the university.

The second paper is written by four authors from Belgium and Denmark (Camacho, Rybels, Coppens & Pineda). The purpose of the paper is to investigate the World Café Technique as a mean to support problem based learning by taking a qualitative approach. The authors identify three aspects of the implementation process of PBL in Higher Education Institutions that can be facilitated through the World Café technique: (1) understanding the principles of PBL through engaging in a constructive dialogue, (2) fostering critical reflections about teaching and learning practices, and (3) changing the organisational culture by promoting collective sense-making and the construction of meaning. Furthermore, the empirical data showed that the World Café technique helps to reveal assumptions, beliefs, and understandings about teaching and learning in general and about PBL in particular. For readers who want to experiment with the World Café technique in a PBL perspective the paper offers an introduction and framing of the technique as well as quotes providing a sense of practice.

The special issue furthermore includes six ***cases*** that exemplify different PBL practices when studying sustainable cities in an action oriented and participatory approach.

The first case is written by five authors from Universidad Simón Bolívar in Venezuela (Soonets, Olaizola, Mena, Dorbessan & Micucci). The purpose of the paper is to show how students in architecture define themselves and the role of architecture together with design methodology and technical knowledge in learning process based on problem solving. The authors of the paper use different approaches in the same institutional context to explore the similarities and differences between Design Studio Learning (DSL) and PBL. The authors exemplifies how DSL can be seen as a type of PBL, but also stress that the PBL approach adds another dimension to DSL and seems to improve the performance of students.

The second case provides another perspective from two authors from Universidad Simón Bolívar (Vasquez & Lara). The purpose of the paper is to show how PBL was used in an urban planning workshop in the third year of study. The authors outline and exemplify the PBL process in the workshop in three steps including 1) problem diagnosis (from complexity and sustainability), 2) prospective (scenarios, concept and strategic lines) and 3) formulation of urban proposals. The authors conclude that compared to the more traditional method in Architecture, PBL methods promoted capacity building for critical analysis, teamwork and consensus building in addressing complex problems of the city.

The third case is written by nine authors from Argentina (Fernández, Orduna, Bonvecchi, Brignone, Carbone, Constantinidis, Otero, Ciarciá & Souza). The purpose of the paper is to show how PBL has been implemented across interdisciplinary areas including urban morphology, urban planning, project development as well as public and institutional relations. The model presented outlines a three-year process, where these areas are combined. Furthermore, it is exemplified, how PBL is integrated in each stage together with a presentation of the experiences in doing so. The authors conclude that PBL increased the students responsibility and self-assessment, allowed more free and wider analysis and succeeded to integrate a range of disciplines.

The fourth case is written by two authors from Italy (Coscia & De Filippi). The purpose of the paper is to show how a project, not born as a PBL initiative in the first phase, developed a problem based and community engaged learning approach. The project used as case example is the Crowd Mapping Mirafiori Sud (CMMS) pilot project, carried out by the Politecnico di Torino (Italy), which besides the academics (students and professors) also includes local institutions and the community in a participatory and inclusive process. This story of this project is framed and exemplified to emphasize the adapted PBL approach. The authors conclude that the combination of problem based and community engaged learning proves to be strategic in the implementation phases of projects, especially in terms of mapping interested parties and connections between networks of actors.

The fifth case is written by five authors from Argentina (Sánchez, Cebrián, Repiso, Torres & Ruiz). The purpose of the paper is to reflect the application of a Project-oriented Problem-based pedagogy in an urban planning workshop. The objective is that students develop professional competences as an Architect-Urbanist including an understanding of the problems and challenges of urban realities. Challenges are pointed out regarding adaptation to new roles and time allocated for both teachers and students. The authors however also conclude that the experience applying the PBL methodology reinforces the pedagogical approach in terms of collaborative learning, perspective shifting and realization of the multidisciplinary nature of the planning process.

The sixth case is written by three authors from Mexico (Aparicio, Hinojosa & Zapata). The case describes how different academic programs from the Autonomous University of Nuevo Leon (UANL) were integrated in a learning unit using PBL methodology. The case tells the story from the initial introduction to PBL, to PBL experimentations in different pilot groups addressing different urban areas. Based on this case, it is concluded that students favour working in interdisciplinary teams, but it challenged the teachers to monitor students learning process and cope with a different time distribution of activities. Furthermore, it was observed that when contextual learning is relevant for students, as in the PBL courses, there is a great potential for projects to add value beyond the intended goals for learning.

We hope that you will enjoy the reading.

Innovating Education for Sustainable Urban Development through Problem Based Learning in Latin America: Lessons from the CITYLAB Experience

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ABSTRACT

This article discusses the challenges and opportunities identified in the implementation of the Citylab project in Latin America during the period of 2015-2018. The project was funded by the Erasmus+ Key action 2 programme of the European Union. The project aims to innovate teaching for sustainability in higher education institutions through Problem Based Learning (PBL). Opposed to traditional teaching methods, the pedagogical approach of PBL is a learner-centred approach that takes a complex problem as point of departure instead of existing established knowledge. Since application of such learning methods is limited in Latin America, the Citylab project attempts to introduce PBL in the existing curricula of 12 Latin American universities through the implementation and development of interdisciplinary Citylab modules focusing on sustainable urban development.

First, the role of PBL in education for sustainability is discussed in a broader theoretical context. Second, the goals, implementation strategies and results of the

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Citylab project will be presented. Third, we highlight some critical issues and success factors experienced during the project. The findings of this paper are based on (1) self-reported questionnaires from the partners at the end of 2017; (2) on-site visits by the authors and expert visits; (3) focus groups, interviews and conversations with project leaders of the participating institutions during the project.

Depending on the institution, the project results were varying in terms of innovation and upscaling potential. Critical factors were related to the role of the project leader in the organization, the flexibility of the implementation and cultural differences. Internal regulations created both incentives and disincentives for participation. Competitive elements in the project and available resources for equipment can act as stimulators in some cases. The challenge lies moreover in detecting windows of opportunities for change in order to accomplish curriculum reform and by doing so, pursue continuation of the PBL approach after the project's horizon.

LEARNING FOR SUSTAINABILITY WITH PROBLEM BASED LEARNING

Article 2.3 of the Nagoya declaration on Higher Education for sustainable development of the United Nations Decade for Education on Sustainable Development recognises that higher education institutions play a crucial role:

"to develop students and all types of learners into critical and creative thinkers and professionals to acquire relevant competences and capabilities for future-oriented innovation in order to find solutions to complex, transdisciplinary and transboundary issues, and to foster understanding and practice of collective values and principles that guide attitudes and transformations, respecting the environmental limits of our planet, through education, training, research and outreach activities (HESD, 2014, art. 2.3)".

In Latin America, initiatives have been taken to give sustainability a more prominent place in the learning outcomes of higher education institutions (Sáenz, 2015). However, there is a growing awareness that also teaching methods matter. The type of competences and skills that are required in sustainability education stretches beyond what traditional education usually delivers. Sahlberg and Oldroyd argue that the bureaucratic industrial oriented and standard driven approach to education is inadequate to face the challenges that lie ahead and that drastic reform is needed (Sahlberg and Oldroyd, 2010). Thomas argues that teaching approaches related to sustainability must focus on elements relating

to the process of learning, rather than the accumulation of knowledge (Thomas, 2009). Some scholars advocated that curricula in sustainable development need to be interdisciplinary and cross-cultural (Li et al., 2018), oriented at deep learning rather than rote memorisation (Warburton, 2003) and stimulate system thinking, anticipatory and critical thinking (Rieckmann, 2012). Others have argued that active collaboration with various stakeholders throughout society—transdisciplinarity—must form another critical component of sustainability efforts (Trencher, Bai, Evans, McCormick, & Yarime, 2014; Yarime et al., 2012).

Problem based learning (PBL) is considered a viable teaching method for sustainability education (Li et al., 2018; Thomas, 2009), that meets many of the criteria of proper sustainability education. PBL is an inquiry-driven learning method in which learners engage in a self-directed learning process based upon a real life problem (Kwan, 2009). PBL is typically learner-centred (Hmelo-Silver, 2004). This means that the learners assume active control over their own learning process while teachers take the role of coaches rather than instructors (Kolmos et Al. 2008). Successful PBL learning experiences start from ill-structured problems which have no straightforward right solution and allow free inquiry. Typically, students work cooperatively in small groups (Bate et Al. 2014). The approach is oriented to developing high level skills as depicted in the top of Bloom's revised taxonomy (Anderson e.a., 2001). As learners have control over their learning process, it is stated that PBL stimulates intrinsic motivation and critical thinking (Zabit, 2010). Moreover, PBL changes the nature of how knowledge is transferred and created. In traditional education, students learn general models and theories which they can apply to solve future problems. Conversely, in PBL the process starts with problems which the students face and motivates them to search for knowledge to solve them. PBL knowledge is developed during the inquiry and thus context specific. However, rather than focussing on the substantive aspects of knowledge, learners become trained in developing skills to address new and unknown complex problems. Table 1 summarises some of the important differences between "traditional" courses and "PBL" courses

	From: Traditional courses	To: PBL courses
Orientation	*Teacher centered*	*Learner centered*
Teaching forms	*Ex-cathedra teaching*	*Supervising, coaching and consulting*
Content	*Theory-based,* *Knowledge is given*	*Problem or project based,* *knowledge is constructed on the basis of complex problems or projects*
Scope	*Monodisciplinary*	*Multi- and Interdisciplinary*
Learning process	*Individual, Passive*	*Group work, Active*
Evaluation	*Dominantly summative evaluation, oral or written exams*	*Formative & summative , jury's, peer evaluation, self evaluation*

Table 1: Differences between traditional courses and PBL courses

PBL is not a uniform approach and in reality different varieties exist. Barrows differentiates six different types of PBL which vary in two underlying dimensions: the level of structuring of the problem and the degree of self-directedness (Barrows, 1986). Project based and case based learning are methods that are related to problem based learning. In project based learning, learners are provided with a general challenge or overall objective and the learning process involves the design and development of possible solutions. Case based learning helps learners to understand important elements of a more structured problem, and to develop critical thinking skills in assessing the information provided, identifying logic flaws or false assumptions (Walker, Leary, Hmelo-Silver, & Ertmer, 2015).

IMPLEMENTING PROBLEM BASED LEARNING IN LATIN AMERICA

Motivated by its pedagogic potential for sustainability education, the Citylab project aims to innovate teaching by introducing Problem based learning, in particular related to urban sustainability in Latin America. It also aims to foster interdisciplinary cooperation in education on urban sustainability. Finally, the Citylab project aims to contribute to set up partnerships between universities and external actors, in particular local governments.

The project has been developed within the framework of Erasmus+ key action 2 by a consortium of 17 partners. In total, 5 European and 12 Latin American universities participated. The actions under this program make it possible for organisations from different participating countries to work together, to develop, share and transfer best practices and innovative approaches in the fields of education, training and youth. The project was initiated by the University of Antwerp in cooperation with Columbus Association which received funding early 2016 and ran until October 2018. The University of Antwerp coordinated the project.

Implementing learner-centred innovations, in particular in the context of international cooperation, poses specific challenges and problems. Schweisfurth (2011) identifies different barriers in implementing such approaches in low and middle-income countries such as unrealistic expectations on the side of the program sponsors and education institutions, the lack of proper resources for staff and material, cultural differences that inhibit coaching teachers roles, and the lack of power of the implementers to change the institutional status quo. Especially cultural problems were encountered in educational reforms in multiple countries in Africa (Vavrus, 2009), leading to the metaphorical description of "tissue rejection" of learner centred approaches (Harley, Barasa, Bertram, Mattson, & Pillay, 2000). Also the upscaling and sustainability of the project can be a particular challenge (Constas & Sternberg, 2013).

In the CITYLAB project, implementation issues and possible "tissue rejection" had been considered in the conceptualization of the project. To avoid these, four principles were used to guide the development of the implementation strategy: (1) implementation flexibility (2) contextualisation, (3) upscaling strategies and (4) incentivising teachers and institutions. An overview of the project and its different components is given in figure 1.
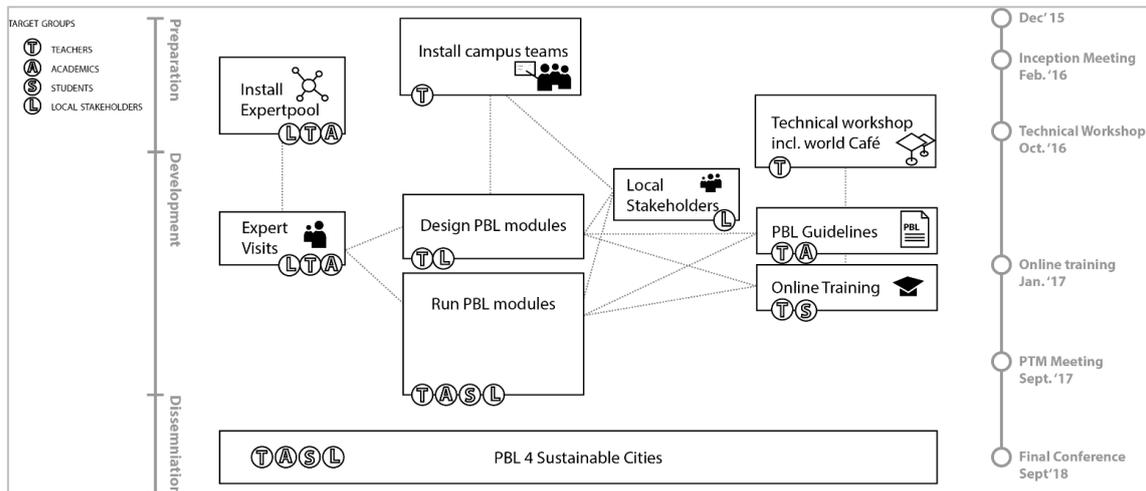

Figure 1: Implementation process CITYLAB LA

Implementation Flexibility

With 12 partner universities in Latin America, project implementation had to be sensitive to national and local constraints and opportunities. Rather than seeking a uniform approach for all the partners, we allowed a flexible implementation of PBL in the educational curricula, in so called "PBL modules". We hereby aimed to avoid extensive top-down curriculum reform which generally takes years to complete and can meet serious resistance. Participating universities were autonomous in deciding which modalities of PBL to implement, ranging from light to more full versions of PBL. The design and implementation of the modules at the university level was done by local "campus teams", with campus team leaders formally responsible for local implementation. Campus teams were in charge of designing "PBL modules" that could take various forms. However, they had to meet basic criteria reflecting a PBL approach:

1. The module had to be accredited and part of a regular curriculum
2. The module had to reflect basic PBL principles. Students learn collaboratively and teachers act as supervisors.
3. The module addresses an urban problem and is oriented to a contribution to solving one or more sustainable development goals (SDG's), as defined by the 2030 sustainable development goals adopted by the United Nations Member states on 25 September 2015

4.   The module had to run in close cooperation with partners from local city governments and organizations

5.   The module had to be interdisciplinary: staff and students from at least 2 different faculties within the university had to be involved

The PBL-modules could be a transformation of an existing course, or a new one. They could be compulsory, elective courses or summer schools. PBL implementation could vary from single courses to whole programs in principle.

Contextualising

In order to address cultural differences in teaching, we followed the advice of Varvus, Chisholm and Leyendecker to adopt a constructivist approach to education in local contexts (Chisholm & Leyendecker, 2008; Vavrus, 2009). The PBL-reform has been set up as a mutual learning process between countries in Europe and countries in Latin America, allowing the development of a culturally embedded form of PBL, rather than an approach that aims to export European educational practice to other contexts. The mutual learning process started with the development of PBL guidelines at a three day workshop with teachers from the different campus teams in the format of a world café (Brown & Isaacs, 2005). The discussion centred around fundamental issues in implementing PBL: curriculum design, the role of teachers and students, evaluation of students and working with external actors. The format of the world café stimulated appropriation and customisation of the PBL approach (see also Camacho, Rybels and Coppens in this issue). It was also intended to provide concrete guidance to the design and development of CITYLAB modules. The results of the discussion have been integrated in PBL guidelines. This is a set of recommendations on the design and implementation of PBL courses in Latin America which was supported by the core group of participating teachers in the program. As part of the process, an online training program was developed for teachers, in which the basics of PBL were explained. The online training program also included reference material and access to blogs in which the campus teams could post provisional results of their PBL module. Teachers involved in the campus teams were invited to subscribe in the online training program.

Upscaling Innovation

The project's implementation had been inspired by insights of niche management (Schot & Geels, 2008). The central idea of niche management is to create protected spaces which allow the development of new innovative practices in which a reconfiguration of actors and their techniques can occur. Strategic niche management recognizes the institutional inertia which innovations typically have to struggle with, but assumes that under the right window of opportunities, innovative niches can upscale to system wide innovations. Innovations in teaching are often frustrated by persistent university institutional structures

that regulate accreditation, evaluation and promotion of staff and resource allocation. However, niche management assumes that a combination of pressures in the wider socio-technological landscape and local innovation can lead to system innovations.

The Citylab modules are considered as innovative niches. Most of the campus team leaders have been recruited in faculties which contained programs in urban planning or architecture. The project proposal assumed that these programs would be most suited to start or to expand educational innovation within universities. Programs in architecture and urban planning typically have a tradition in more learner-centred approaches in the form of the design studio or the architectural studio. Studio-based learning has some features in common with problem based learning, although substantial differences exist (De Graaff & Cowdroy, 1997). Studio-based teaching at architectural schools generally have little explicit pedagogic concepts as they are rather based on tradition than an explicit educational strategy. Also, architectural design studio's tend to be loosely coupled if at all from more theoretical courses in their curriculum. Nevertheless, teachers within architectural studios are generally familiar with students working in groups on complex problems and these faculties have the necessary infrastructure to organise more learner-centred learning methods.

Citylab modules required the involvement of at least 2 faculties so that teachers were motivated to recruit fellow teachers from other disciplines, not familiar with studio-based teaching or problem based learning. The project assumed that the personal networks of the campus team leaders within the university would be sufficient to attract a group of motivated teachers to participate in the project and to continue participation after the lifetime of the project.

Incentivising

As participation in the campus team was voluntary, the project had to provide adequate incentives for teachers, students and university administration. In order to create some motivation, the Citylab project was set up as an international competition between students participating in the modules and working on the sustainable development goals in cities. Each of the participating institutions could select one team of students for the competition, based upon the output they produced in the modules. The criteria for the student competition had been set by the campus teams and include:

- The learning process and PBL experience
- The interdisciplinary of the work
- The collaboration with external actors
- The contribution to the sustainable development goals.

The student teams were invited to present a poster at the project's final conference in Bogotá. The jury was composed by members of the United Cities and Local Governments, UN Habitat, experts in Problem Based learning and representatives of university associations in Latin America. It was expected that the competition would contribute to the sustainability of the reform. If the competition within the network would have a recurrent character, there would be a lasting incentive to create PBL modules at universities.

A second incentive was given through a budget for equipment. Each campus team could decide to spend a budget to invest in equipment for running their module. A final incentive was given by the expert visits. Campus teams could decide to invite up to two scholars from other participating institutions to visit their Citylab module. It was assumed that the visit of academics from other institutions would give an incentive to meet the project criteria. The experts were also involved in evaluating the visited module during their site visit.

METHOD AND RESULTS

Method

The project implementation and results have been monitored throughout the project, both through internal and external evaluation methods. For internal evaluation and monitoring, the consortium organised regular online meetings, four face-to-face project team meetings and two workshops (see figure 1). During the project team meetings, the participating institutions presented their Citylab module as poster presentation in an agreed uniform format. This allowed the project management team to compare easily between modules and to keep a track of the implementation of the project.

The project also hired Columbus association to evaluate and monitor the implementation and impact of the project. External evaluation activities included surveys and focus groups among students, teachers, local actors and campus team leaders in different stages of the project. An overview of the collected data is given in figure 2.

TARGET	NO. OF SURVEY RESPONSES	FOCUS GROUPS	MAIN DIMENSIONS
STUDENTS	197	20	• Learning experience • Skills development • Interaction with local actors • Improvement possibilities
TEACHERS	87	20	• PBL • Skills and motivation • Collaboration with external actors • Interdisciplinary • Benefits and improvement possibilities
LOCAL ACTORS	29	N/A	• Satisfaction • Collaboration with Universities • Students performance • Improvement opportunities
CAMPUS LEADERS	13	17 (EU+LA)	• Institutional results • Collaboration with external actors • Interdisciplinary • Benefits and improvement possibilities

Figure 2: Overview of data collected in external evaluation activities

The survey was held during the last months of the project with an online questionnaire sent to students and teachers. From the 1482 students that participated in one of the modules, 193 students responded, whereas from the 192 academics that have been involved, 75 teachers responded, resulting in a response rate of respectively 13% and 39%. In addition to the survey, we organised focus groups with students and teachers during the mid-term technical workshops in Lima and Buenos Aires and at the final conference of the project. We also organised focus groups with campus team leaders.

Outcome of the project
During 2016 and 2018, 33 Citylab modules have been created. Although the project was targeted to teaching innovation in Latin America, four European universities also decided to create their own module and to participate in the project. In total the project reached a total of more than 1482 students and 192 teachers on both continents.

Most of the modules that have been created are modifications of existing courses in curricula. Some universities have also created new courses or multidisciplinary workshops. By adjusting existing courses, lengthy curriculum reforms and accreditation processes were avoided. Most modules were set up as elective courses at the undergraduate level. As 10 of the 12 campus team leaders in Latin America are related to architecture or urban planning, this is also the organizing faculty of 10 of the 12 modules. One module was organised by the mechanical engineering department (University of Pereira) and one by the faculty of economics and finance (University del Pacífico). The modules explicitly addressed one or more sustainable development goals, in particular SDG 11 regarding inclusive, safe, resilient and sustainable cities.

There were strong variations between the interdisciplinary setup of the modules. All of the modules had a multidisciplinary team of teachers involved, but in some cases the different disciplines involved were strongly related such as landscape architecture, urban planning and architecture (in Universidad Federal de Rio de Janeiro for instance). In other cases a more novel combination existed between teachers from more distant related faculties (Rosario, Pereira, Nuevo Leon, Guanajuato). In the University of Rosario for instance, the faculties of Science, Law, Journalism and Public Opinion, Urban Management and Sociology have been involved in the module. Most modules were open to students from other programs in other faculties as well, although some modules only targeted students of the curriculum of their own faculty.

All institutions involved external actors in their modules, with a dominant participation of public authorities and municipal governments. In Brazil, Venezuela and Colombia also private foundations or residential associations have been involved in the modules. The involvement ranged from light forms of interaction such as field trips or lectures given by external actors to more committed forms in which external actors have been active in the development and the implementation of the module. In some modules the external actors played a role in the evaluation of students and/or participated also as supervisors.

To support the modules, the Citylab project developed an online learning training for participating teachers, based upon the jointly developed PBL-guidelines. The aim of the online training was to develop a general understanding among participating teachers of Problem based learning, PBL course and curriculum design, PBL teaching methods and evaluation. The online training was run on a Blackboard platform and comprised different components: (1) an online PBL training with instructional videos and texts, (2) a blog in which the different participating modules posted their activities and progress, (3) a section with a discussion board to discuss particular issues within PBL and (4) a section with online resources on PBL. Although the online learning was initially targeted to teachers, some institutions also subscribed their students in the online course. It was felt that a better understanding of PBL principles among students would increase the success of changing from traditional learning methods to learner-centred methods. In total, 450 teachers and students participated in the online training.

During the implementation of the modules, the Latin-American universities could invite experts to support the development of the Citylab modules and to build PBL capacities. These expert visits were demand-driven, meaning that the receiving institution could identify a suited expert from the expert database which was developed at the beginning of the project. In total 14 experts from 5 institutions visited 11 different universities in Latin America.

The project ended in a three day conference in which participating teachers and students presented the results of their modules. Teachers and students in the participating institutions were also invited to reflect on learning for sustainability in academic papers. The scientific committee received about 31 papers representing 81 authors. The teachers involved in the modules documented their module and discussed it during a "world kashba", a modified version of the world Café format. The selected student teams of each institution presented the output of their work and their experience in a poster exhibition.

Impact of the Project
In general, the satisfaction of working with interdisciplinary PBL modules was very high. The impact of the project was measured on the different target groups of the project: teachers, students and local actors.

From the survey results among the teachers (N=75), we found that teachers believe that the didactic methods of their Citylab modules significantly contributed to the stimulation of critical thinking and complex problem solving of students, to create active learning environments and to work with interdisciplinary teams. Among less developed skills they identified: project management abilities, assessing the learning outcomes and negotiation skills for working with external actors. 99% of the surveyed teachers (N=75) feel more motivated to implement PBL in their courses after the project.

According to the student survey (N=193), PBL modules contributed most to improving skills in collaboration and team work, critical thinking and information retrieval and analysis. Less developed skills include: communication, project management and interpersonal relations.

The external actors (N=29) expressed a high satisfaction in working with universities during the project: 76% considered the collaboration very successful and 24% successful.

Continuation and Sustainability
The sustainability of the innovation was also ensured by the end of the project. 90% of the surveyed teachers stated that the continuity of the PBL modules was ensured or very likely to continue after the project lifetime. For 13% of the teachers continuation was only moderately likely. Less successful was the upscaling of the project: 53% of the teachers stated that the possibility to extend the project to other academic areas is only moderately likely.

It is important to note that the data collected in the project has some limitations. First, the data does not allow us to compare the impact of PBL based education compared to

traditional methods, as there is no data available for control groups. Therefore, on the basis of the gathered data, we are not able to conclude if PBL methods outperform more traditional methods in learning for sustainability. Such a comparison lies however out of the scope of the project and was taken as an assumption based upon earlier discussions in the literature on sustainability education.

Secondly, the collected data could be subject to a reporting bias in the sense that respondents overstate the outcome and impact of the project. The teachers involved in the surveys do have a stake in reporting more positive outcomes as the project is evaluated and financed on the basis of its performance. On the other hand, the corroboration of similar findings among students and local actors on the performance of the project in the focus groups and expert visits do support the positive results.

DISCUSSION: CRITICAL SUCCESS FACTORS AND BARRIERS

Despite the overall success of the project, the development and implementation of Citylab modules demonstrates a substantial variance among the participating institutions. Some Citylab modules are only small transformations of existing courses which already exhibit learner centred approaches. In these institutions, the innovation and upscaling potential of the Citylab project remains limited. In other universities, results have been more substantial and in some cases PBL was implemented in a broad curriculum reform of multiple faculties. This raises the question on which critical factors affected the implementation of the project.

A first factor was related to the composition of the campus team and the selection of the project team leader. The project team leaders' position within the university clearly affected how the project was implemented. In some institutions, the project team leader was part of the university board and had more leverage on curriculum reforms (University of Lima, University Belgrano). In other cases project team leaders were part of the university administration (University of Cordoba), which could implement more easily curriculum changes that affected multiple departments. In the institutions in which the project team leader was more peripheral in the department or faculty, the transformation of the curriculum and learning methods was generally more limited (UFRJ, Santa Catarina). Support from university policy makers therefore strongly affects the outcome, certainly when these policy makers have knowledge of and experience with Problem based learning (fi Pacifico). Positions within universities and faculties are however volatile and changed during the project, affecting the impact of the implementation.

Next to position, also motivation of the campus team members mattered. The transformation of courses in Citylab modules required a substantial effort and time investment from the participating teachers, often without remuneration from the project's budget. In some cases the motivation therefore depended purely on personal commitment to deliver better education. The competitive element of the Citylab project and the opportunity of operating in a transnational community also created a strong incentive for both teachers and students to participate in the project. Even the Venezuelan partners, which faced a deep national crisis during the timespan of the project continued their engagement to the project. An unexpected outcome of the competition was the development of Citylab modules at 4 of the 5 European universities in Europe. The project did not foresee any financial resources for this. However, students and teachers participated on a voluntary base. From the focus groups with teachers we learnt that campus teams usually were built on existing networks of teachers, sharing a common interest and mind-set. This proved beneficial for the implementation and development of the modules, but also impacted the potential reach and upscaling of the project within the university. By involving only existing and established networks of teachers from other departments, the project probably missed opportunities for new networks that might result in more innovative interdisciplinary modules.

A third critical factor affecting the implementation was related to the flexibility of implementation. The flexible approach of the project allowed for a diversity of effective implementation strategies, and a variety of degrees in PBL implementation. In some cases the road of minimal effort was followed in order to meet the Citylab criteria. Some partners opted for very moderate transformations such as a slightly adapted form of an architectural studio. Other modules opted for a more structured and university wide approach. More structural transformations occurred in those institutions with ongoing curriculum reforms and a strong commitment from the chancellor's office to learner centred approaches (U Rosario and U Pereira). Innovation upscaling required thus the right window of opportunity, which depended on the opportunity of ongoing reforms and a will of university policy makers to implement PBL.

Internal university regulations proved to be a fourth critical factor as they created incentives and disincentives of participation in the campus teams. In some universities, attracting teachers from other faculties proved to be daunting as teaching allocation regulations could not cope with interdisciplinary modules in which teachers of more than one faculty are involved. Moreover, teaching allocation rules generally do not take into account the labour intensive character of learner centred approaches, especially at the undergraduate level where mass education is still the general rule. Also involving students from other faculties was problematic as the scheduling of courses needed to be coordinated by the university administration. Internal reimbursement procedures acted as

strong demotivators for participation in the project. For instance, due to specific internal financial regulations some of the teachers had to pre-finance some of the international meetings with private resources.

Fifth, in the focus groups among teachers, it became clear that the international mobility through expert visits had a significant impact on implementation. Some campus teams reported that the visit of an external expert strengthened their position to convince the university administration in supporting the PBL approach in the Citylab modules. Not all universities made use of the possibility to invite experts. An important barrier was the specific funding rules of the Erasmus project, which did not fully cover the costs associated with the expert visits for the sending institutions.

Finally, few teachers reported cultural differences and some form of "tissue rejection", moreover in the expectations of students. In Mexico for instance, peer assessment was used to evaluate the module, which met criticism from the students. Also in some modules, teachers and students were having difficulties to leave their traditional roles and to engage into more coaching forms of teaching. In the focus groups with students, attention was raised to involve students in an earlier phase of the design and implementation of the modules. The project probably missed opportunities in preparing students to engage in new teaching methods. According to some students, the online course helped them better to understand Problem Based Learning and the mutual expectations in the Citylab Modules. The online course was originally not intended for students and only in a few institutions students have been enrolled on a voluntary base in the training.

CONCLUSION: LEARNING FROM CITYLAB

Although it is increasingly recognised that the urban professionals of tomorrow will need new range of skills in dealing with the challenges of sustainable urban development, there is still a large inertia in educational methods in higher education in South America. Projects aimed at educational innovations, in particular in international settings, have often failed to deliver a sustainable impact on education.

The results from internal and external evaluation data of the Citylab project seem to demonstrate that a set of well-designed implementation strategies can overcome reform barriers. Based on the theory of niche management, the project developed an implementation strategy by selecting niches of innovation at universities and devised a set of incentives to upscale innovative practices throughout the university. These niches have been expanded by involving students and teachers from more traditional faculties.

The fact that 99% of the teachers that have been involved in a Citylab module reported that they will continue using PBL in their courses gives some evidence that the project lead to a sustainable implementation.

PBL is not a strictly defined concept or procedure, but leaves room for interpretation. This was beneficial to the implementation of the project as it leaved room for flexibility in the implementation and appropriation to the local context of the higher education institution. The flexibility of implementation allowed to make better use of local opportunities and resulted in a diversity of implementation modalities. Appropriation was achieved by involving the participating teachers in the development of PBL guidelines and an online training. The evaluation data showed only limited instances of "tissue rejection" of PBL, despite the cultural differences in teaching and education in the different participating countries. However, the project would have benefited from more involvement of the students in the design and implementation of the Citylab module.

Introducing a competitive element in the international network of higher education institutes created incentives and motivation for students and teachers to adopt new teaching methods and to collaborate with colleagues in other faculties and external actors. Internal regulations and intrinsic motivation proved to be equally important.

The upscaling of the project is less certain and depends mainly on local "window of opportunities" for reform that are supported by local university policy makers. Upscaling is more likely when there is a strong and simultaneous involvement and engagement from the university administration, faculty members and university policy makers to reform educational methods.

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World Café as a Participatory Approach to Facilitate the Implementation Process of Problem-Based Learning

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ABSTRACT

Shifting from a traditional lecture-based teaching approach to a student-centred approach, such as Problem-Based Learning (PBL), demands significant changes in Higher Educational Institutions (HEIs). It requires changes for teachers, students, institutional management, and even the physical learning environment. Once a university is not designed from the beginning to insert this type of pedagogy, it is difficult to promote a change of this nature if the institution is committed to a more traditional pedagogical approach. Therefore, introducing PBL as an important innovation faces problems of conservatism, institutional inertia, path dependency, lack of knowhow and knowledge among teachers, poor institutional support, and poor connection with societal and economic actors. This article presents the World Café technique as a participatory method to identify and overcome some of the challenges when implementing a PBL approach. We confront the results of the Citylab World Café with the challenges identified in the literature. The authors identify three aspects of the implementation process of PBL in HEIs that can be facilitated through the World Café technique: (1) understanding the principles of PBL through engaging in a constructive dialogue, (2) fostering critical reflections about teaching and learning practises, and (3) changing the organisational culture by promoting collective sense-making and the construction of meaning.

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INTRODUCTION

Over the last 40 years, the study of Problem-Based Learning (PBL) in educational settings has been consolidated as a field of theoretical and empirical work. Different contributions to its study have discussed the relevance of PBL as a pedagogical approach from teaching, learning, and organisational perspectives. Within the organisational perspective, which is the focus of this article, several contributions have concluded that leadership, organisational culture, and change management play a significant role in successful implementation of PBL (Camacho, Coto, & Jørgensen, 2018; Kolmos, 2010).

The shift from a traditional lecture-based teaching approach to a student-centred approach, such as PBL, demands significant changes in educational institutions. These changes require reflections on the teaching and learning practises and challenge several of the established values and assumptions about how to teach and how to learn in conventional universities. In this context, PBL constitutes a fundamental strategic innovation. This requires changing mental models by questioning and challenging current practises and viewing education in a new way by leaders and organisational members (Jacobs & Heracleous, 2005). In this article we argue that implementing PBL may better be supported by using participative approaches that mobilise people to share and discuss their experiences, values, and assumptions in a collaborative learning experience rather than implementing PBL top down.

The World Café is a known technique of participatory methods for change (Bushe & Marshak, 2009; Raelin, 2012). It enables a step-by-step conversational process of engaging large groups of people who share interest in a certain topic, problem, or opportunity in order to create a shared understanding (Brown & Isaacs, 2005).

This article examines how the World Café technique helps to identify and eventually overcome some barriers when implementing a PBL pedagogical approach. To produce change, this examination is necessary to create and share knowledge about PBL itself, share understanding of university organisation and organisational practise, and redefine values, assumptions and beliefs about learning and teaching practises.

Within the Citylab project, a World Café was developed (Citylab World Café) to initiate a dialogue for the implementation of PBL among 17 European and Latin-American Higher Educational Institutions (HEIs). By confronting the results of the Citylab World Café with the implementation challenges that are found in the literature, we argue that the World Café technique has the potential to support the needed change process.

In the next section, we briefly present the World Café technique. Then, we discuss some of the challenges to implement PBL found in the literature. This is followed by a methodological description of the World Café developed in the Citylab project. Following that, we present and discuss our practical experience of using the World Café technique as a participatory method to foster change toward PBL within the Citylab project. Finally, we provide a conclusion.

WORLD CAFÉ: THEORETICAL AND EMPIRICAL UNDERSTANDING

The concept of World Café was first coined by Brown and Isaacs in 1995. Since its creation, the technique has been widely used in diverse contexts and fields. Fallon & Connaugton (2016, pp. 3–5) present a review of different applications of World Café around the world. The technique can be defined as a step-by-step, conversational process of engaging large groups of people who share an interest in a topic, problem, or opportunity (Brown & Isaacs, 2005). Fouche and Light (2010, p. 28) define World Café as 'a conversational process that helps groups to engage in constructive dialogue around critical questions, to build personal relationships, and to foster collaborative learning'. The technique emphasises inquiry and understanding rather than problem solving; in other words, the method creates a collective understanding rather than action plans (Prewitt, 2011).

In a World Café, participants are seated in groups of four to five people around tables that are arranged similar to a café setting (small decorated tables to encourage conversations). The conversations are guided by predetermined questions that concern the participants. Participants move around to different tables discussing the question(s). Each table has a host who shares highlights from the previous conversation. The main assumption is that participants cross-pollinate ideas and insights when they move around tables. As the conversation progresses, new discoveries emerge and collective knowledge grows and evolves (Brown & Isaacs, 2005; Fouche & Light, 2010; Prewitt, 2011). Regarding the value of dialogue and conversations in World Café, Hurley and Brown (2010, p. 3) state that

> talking together has been a primary means for discovering common interests, sharing knowledge, imagining the future, and cooperating to survive and thrive. The natural cross-pollination of relationships, ideas, and meaning as people move from one conversation to others enables us to learn, explore possibilities, and co-create together. From this perspective, conversations are action—the very

heartbeat and lifeblood of social systems like organizations, communities, and cultures.

Table hosts have a relevant role as facilitator. They compile notes of the emerging ideas and are advised to provide clear instructions and to procure, weave, and connect ideas generated from the dialogue (Lorenzetti, Azulai, & Walsh, 2016). Hosts may foster or hinder creativity, knowledge creation, and collaborative learning depending on their skills. Therefore, the facilitator 'needs to be highly focused on helping participants find shared meaning on a subject of deep collective importance' (Prewitt, 2011, p. 196).

There are seven design principles to be carefully considered when creating the environment for dialogue, knowledge sharing, knowledge creation, and collaborative learning: (1) setting the context, (2) creating a hospitable space, (3) exploring questions that matter, (4) encouraging everybody to contribute, (5) connecting diverse and different perspectives, (6) listening together to identify patterns, and (7) gathering collective discoveries (Hurley & Brown, 2010).

In Table 1, the values of World Café as identified in different international research projects are presented.

(Fallon & Connaugton, 2016; Fouche & Light, 2010; Preller, Affolderbach, Schulz, Fastenrath, & Braun, 2017)	Enable knowledge sharing and knowledge creation: tacit and explicit
(Fallon & Connaugton, 2016; Thunberg, 2011)	Foster inclusiveness
(Fallon & Connaugton, 2016; Fouche & Light, 2010; Thunberg, 2011)	Provide conditions for equal participation
(Fouche & Light, 2010; Thunberg, 2011)	Engage in constructive dialogue
(Fouche & Light, 2010; Prewitt, 2011)	Promote common sense-making and shared construction of meaning
(Fouche & Light, 2010; Gill, Ramsey, Leberman, & Atkins, 2016; Preller et al., 2017)	Promote networks, integration, and community building
(Fouche & Light, 2010; Preller et al., 2017)	Allow for collective discoveries
(Preller et al., 2017)	Ensure effective data collection method
(Gill et al., 2016; Preller et al., 2017; Thunberg, 2011)	Foster collaborative and reflective learning
(Thunberg, 2011)	Foster motivation and positive work environments
(Gill et al., 2016; Thunberg, 2011)	Promote critical reflection
(Gill et al., 2016)	Promote the construction of trusting relationships

Table 1. Values of the World Café technique, identified from the litterature

THE CITYLAB WORLD CAFÉ

The Citylab project aimed to stimulate innovation in teaching and learning in Latin-American and European HEIs through the introduction and further development of interdisciplinary and transdisciplinary PBL methods, thus developing key competences and skills among Latin-American and European students. To achieve this aim, the project brought together 17 universities from the two continents. As part of the project, each institution developed a Citylab Module – interdisciplinary accredited PBL modules with students and teachers from different faculties. These modules focused on sustainable cities, a common theme used as a vehicle for innovation in teaching, since sustainable cities can be considered one of the key places in which innovation is already present and which offers opportunities to broaden the modules throughout the university.

In order to identify the challenges related to the implementation of PBL that each HEI faced, a technical workshop was organised and hosted by the University of Lima in October 2016. During the workshop, the Citylab project leaders needed to find a way to share their knowledge and insights in a short time that allowed for active participation by all members. Moreover, a technique needed to be developed that could be reproduced to facilitate the PBL implementation process at the organisational level of each HEI.

Therefore, the World Café technique was introduced during this technical workshop to allow large group conversations on the challenges, experiences, and opportunities of PBL implementation.

The Citylab World Café included two representatives from each member of the project. In total, 40 participants with different professional backgrounds and areas of expertise from 17 universities as well as two associated partners (UCLG and Columbus Association) attended the project.
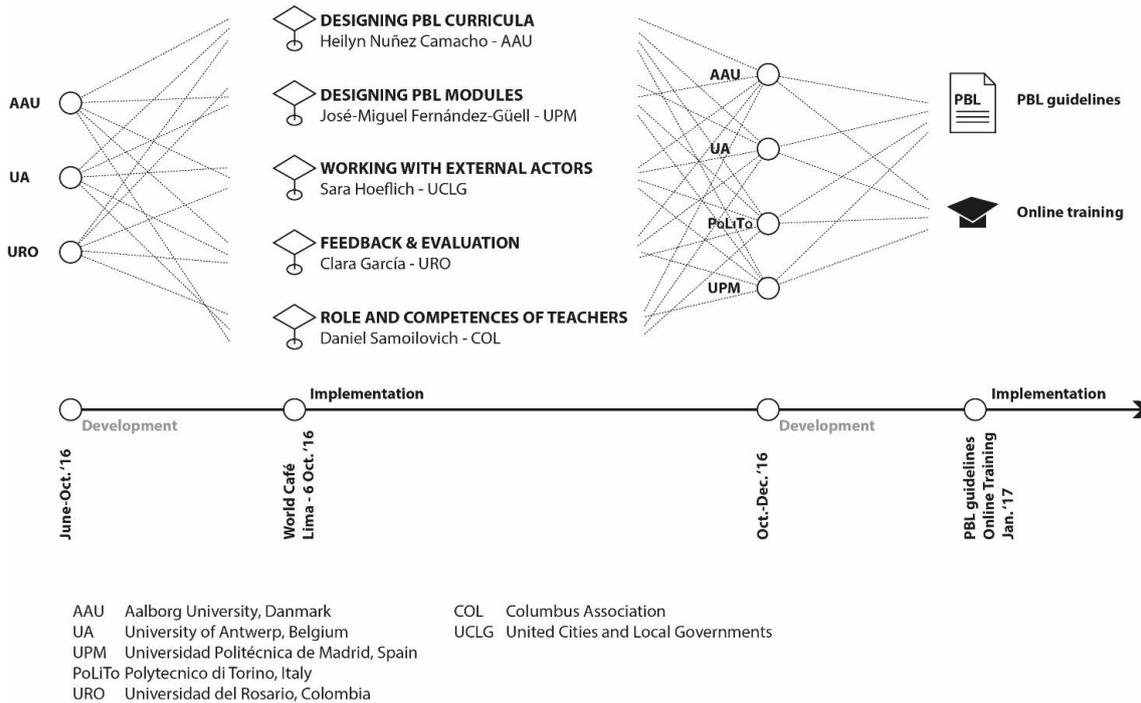
DESIGNING PBL CURRICULA
Heilyn Nuñez Camacho - AAU

DESIGNING PBL MODULES
José-Miguel Fernández-Güell - UPM

WORKING WITH EXTERNAL ACTORS
Sara Hoeflich - UCLG

FEEDBACK & EVALUATION
Clara García - URO

ROLE AND COMPETENCES OF TEACHERS
Daniel Samoilovich - COL

PBL guidelines

Online training

AAU	Aalborg University, Danmark
UA	University of Antwerp, Belgium
UPM	Universidad Politécnica de Madrid, Spain
PoLiTo	Polytecnico di Torino, Italy
URO	Universidad del Rosario, Colombia

| COL | Columbus Association |
| UCLG | United Cities and Local Governments |

Figure 1. The development of the Citylab World Café

When designing the Citylab World Café (Figure 1), we brought complementary knowledge and practical knowhow, experiences, and skills from different universities together on the subjects of learning methodologies, interdisciplinary and transdisciplinary approaches, and salient urban problems. In a first phase, Aalborg University (AAU), the Centre for Teaching and Learning from the University of Rosario (URO), and the University of Antwerp (UAntwerpen) were involved. Aalborg University's PBL expertise was invoked to strengthen and structure existing learning approaches with pedagogical support, while UROs' expertise was used to increase the pedagogical quality of existing project-based learning methods in urban design studios. Moreover, the group built on UAntwerpen's considerable experience in engaging societal actors to solve real-life problems as well as attracting multidisciplinary expertise when dealing with urban challenges in their urban design studios. These inputs were used to design the World Café, which consisted of five topics: designing PBL curricula, designing PBL modules, working with external actors and real-life problems, giving feedback and evaluation in PBL modules, and determining the role and competences of teachers and instructors.

During the implementation of the workshop, there were five tables called table cafés. Each table covered one of the topics listed above. The group dynamic consisted of progressive rounds of 30 minutes at each table. After 30 minutes, participants were invited to move to another café table to discuss a new theme. Participants of one table were discouraged from moving all together to the next table café; instead, they were

encouraged to spread out in order to have the opportunity to interact with different people. Each café table had a rapporteur or barkeeper who moderated the discussion and connected the insights from the previous discussions. After five rounds, a plenary session occurred to discuss the general inputs from the five tables and to produce an overview of the conclusions and agree upon further actions. The outcome of the World Café resulted in the development of the PBL guidelines and an online training program for teachers involved in the Citylab Modules, which were two main deliverables of the project.

The first three rounds of each table were audio recorded. The posters presented in the plenary session were scanned and the presentation of each of the rapporteurs was also audio recorded. The data was organized in the following way: the raw data was organized in a table; the questions were placed in the rows and the rounds were placed in the columns; then, in this matrix, notes were taken on the answers given to each question in each round.

A second round of data analysis was conducted by focusing on the role and skills of each rapporteur, the dynamic of each group, the discussion that each question created, the level of difficulty in understanding the questions, the level of engagement with the questions, the influence of the rapporteur on the direction of the discussion, how the common understanding evolved, and how the technique allowed the explicit identification of assumptions and beliefs about PBL, organisational culture, and the teaching and learning processes.

PBL IMPLEMENTATION CHALLENGES

Currently, a number of educational institutions are attempting to transform their traditional teaching approach towards PBL; examples include those involved in the Citylab project, as well as many others reported in the literature (Kolmos & de Graaff, 2007; Li, 2013; Nunes de Oliveira, 2011). Empirical accounts reveal that implementing PBL is a significant change for many educational institutions.

Among the challenges reported in previous empirical research (Bouhuijs, 2011; Camacho, Coto, & Jørgensen, 2018; Kolmos & de Graaff, 2007; Li, 2013; Li, Du, & Stojcevski, 2009; Li & Henriksen, 2010), we discuss three of the most common challenges: change in the organisational culture, change in the teacher value system, and change in the institutional structure and organisation. Additionally, in this section we briefly discuss if participatory change management may be a relevant approach to implement PBL in HEIs.

Change in the organisational culture

In order to understand culture and how it shapes organisational actions, it is necessary to explore the various manifestations and definitions of organisational culture. In the literature it is possible to identify reliable representations of organisational cultures: artefact, values, assumptions (Schein, 2010), symbols, meanings (Alvesson, 2013), and orientations – values, norms, and tacit assumptions (Hoy, Tarter, & Kottkamp, 1991).

We adopt the following definition of organisational culture:

> the collective, mutually shaping patterns of norms, values, practices, beliefs, and assumptions that guide the behavior of individuals and groups in an institute of higher education and provide a frame of reference within which to interpret the meaning of events and actions on and off campus. This definition emphasizes normative influences on behavior as well as the underlying system of assumptions and beliefs shared by culture bearers. (Kuh & Whitt, 1988, pp. 28–29)

Bouhuijs (2011) refers to two cultural clashes when implementing PBL in traditional universities. The first is an epistemological controversy about what knowledge is and what students should learn. He states that the most traditional academia is committed to 'True Knowledge'. This value clashes with the constructivist background of PBL, where the students are allowed to express and deal with imprecise ideas that are developed as they work with real-life events and consider different theories. Students are not corrected on their imprecise ideas about a certain issue; instead, they are guided to create knowledge and better understand the issue at hand and the epistemological tools at their disposal. Therefore, some academic staff would have difficulties understanding and adopting this constructivist theory that is contradictory with their established practise of teaching True Knowledge.

Another aspect of this clash is presented by Li and Henriken (2010) when discussing the challenges to implement PBL in an Australian university. They denominate the event 'pedagogical debate' among the teachers. This case reveals that knowledge coverage is one of the main worries among academic staff. The teachers who were committed to the change and aware that PBL is about cultivation of certain skills and not about knowledge scope found it difficult to let go of the conventional way of delivering knowledge. The researchers reported that teachers organised lectures in addition to the PBL course to guarantee that all knowledge was covered.

The second cultural clash described by Bouhuijs (2011) is related to the type of culture that academia fosters, such as individual professionalism. In contrast, PBL promotes a collaborative and interdisciplinary approach to professionalism. We highlight two

aspects. The first is the fact that the act of teaching is an individualistic practise. Teachers are alone in their classroom; therefore, most of the process of planning and teaching is developed individually (Conole, 2013). To foster this practise at the higher education level, a golden rule of teaching autonomy exists in many universities, which means that teachers decide what to do in the classroom. The second aspect is related to highly ranked academics who believe they can create their own work environment and not be bothered by others (Bouhuijs, 2011). These norms and traditions need to be modified when working with PBL since many activities that are developed should be conducted as a team. Teachers must learn to work collaboratively, and the overall organisational culture will favour or hinder the establishment of this collaborative and learning practise according to existing rules and incentives (Nunes de Oliveira, 2011).

The general argument in the literature is that changes toward PBL require a shift in the university's organisational culture (Bouhuijs, 2011; Camacho et al., 2018; Kolmos & de Graaff, 2007; Li et al., 2009; Nunes de Oliveira, 2011) and the recognition of this fact would allow for the design of strategies to cope with this shift.

Teacher system values

The second required change when implementing PBL is to change teachers' understanding of and experience with teaching and learning. The empirical research reports variations on teachers' personal beliefs and attitudes towards the learning process (Nunes de Oliveira, 2011), rethinking their traditional roles as sole experts and authorities in their interactions with students and colleagues (Al-Beiruty, 2008; Sandoval, Cortés, & Lizano, 2015), adjusting classroom structure and dynamics (Mora, Coto, & Alfaro, 2014), and changing assumptions about learning (Kolmos, 2010; Kolmos & de Graaff, 2007).

We may better understand this challenge by observing it through Wenger's social theory of learning (1998), which embraces four aspects: meaning, practise, community, and identity. Wenger understands learning as a practise of identity formation, a mode of belonging to something meaningful. Thus, learning makes people who they are. Teachers who are involved in the PBL transformation have many years of experience, and they have a learning trajectory that, using Wenger's concept, has formed who they are and what their beliefs are regarding teaching and learning. Changing from a traditional teaching approach to PBL demands the construction of new learning experiences, new practises, a new sense of belonging, and a new identity. Wenger defines identity as a layering of events of participation and reification by which our experience and its social interpretation inform each other. As we encounter our effects on the world and develop our relations with others, these layers build upon each other to produce our identity as a

very complex interweaving of participative experience and reificative projections. (Wenger, 1998, p. 151)

From this point of view, we interpret that implementing a PBL approach creates tension between teachers' existing knowledge, practise, experience, and beliefs, and that this tension needs to be addressed to facilitate new ways of knowing to cover the process of development of teachers' identities as professionals.

Organisational change

As has been mentioned, the implementation of PBL is a change process through which individuals and organisational cultures are modified, demanding a new view of the world, new knowledge to be acquired, and new teaching and learning practises to be created. Furthermore, the institution as a whole must change as well.

The literature demonstrates that universities will face several challenges. For example, Mora et al. (2014) mention changes in the administrative structure of the university, while Sandoval et al. (2015) refer to the curriculum changes in order to allocate the new ways of working within PBL which are not part of traditional teaching approaches, such as the role of the supervisor. Another aspect mentioned in the literature is balancing the semester workload (Sandoval et al., 2015). Both change in the curriculum and balancing the workload will create tension as teachers may see these aspects as an attack on their current status. This restructuring would affect their number of work hours, their individual control of certain courses, and their need to work more collaboratively at the program level. These tensions may lead to resistance to change (Bouhuijs, 2011). However, a change at the curricular, organisational, and structural level at the university must take place in order to be able to work within the PBL approach.

A common aspect mentioned in the literature is the issue of preparation time to implement PBL (Bouhuijs, 2011; Mora et al., 2014; Nunes de Oliveira, 2011; Sandoval et al., 2015). Teachers need time to learn PBL, create new material, learn to work together, and prepare the students, among other aspects. However, it is common that teachers are required to learn new university processes while maintaining their regular workload and their research and publication demands. Therefore, clear strategies to train and inform the staff and to incentivise them to take the new roles should be developed at the management level.

A final comment about some of the challenges faced at the organisational level is reported by Li (2013) and Li and Henriksen (2010), who discuss how the different understandings of PBL brought tension in its implementation in two different universities, one in

Australia and another in China. In those studies, they found that there was no fixed, standardised, single, and uniform definition of PBL, neither within the scientific literature nor among their staff. As the members had their own interpretation of PBL which were not in line with the managerial understanding, the managerial effort to standardise the understanding of PBL prompted significant discussions among the staff. As these authors state, the diversity in PBL interpretations can be attributed to different work experience and educational experience, and those many interpretations should not be seen as incorrect perspectives that need to be corrected; instead, they should be treated in a tolerant and constructive manner.

Overall, these empirical reports demonstrate that the implementation of PBL demands a new way of organising and structuring universities; therefore, to avoid returning to their traditional teaching practise, approaching PBL with a clear change management strategy is necessary to address the complexity and dynamics of HEIs that are changing to PBL (Li & Henriksen, 2010).

Participatory change approach for PBL implementation
Within the PBL field, there are recommendations about how to deal with the change process. A commonly cited approach is the one proposed by Kolmos and de Graaff (2007), who distinguish two strategies for initiating PBL in an educational institution: a top-down approach and a bottom-up approach. Each approach has its strengths and weaknesses. The Kolmos and de Graaff (2007) authors point out that neither of these strategies are sufficient for successful change and propose a combination of the two strategies, which is also the recommendation of Li and Henriksen (2010).

As there are different perspectives about how to deal with a change process for the implementation of PBL, there are also different perspectives about how to conduct change in organisations in general. One of these approaches is called participatory organisational change (Raelin, 2012), where communication, dialogue, and participation are key elements to enable learning, growth, and transformation.

Communication is understood not only as a fundamental aspect of change process but as the process of change itself. Change is created, sustained, and managed in and by communication (Ford & Ford, 1995). Communication, within organisational change, can be classified as programmatic or participatory (Russ, 2008). The programmatic approach is characterized by a top-down monologic communication to obtain approval, commitment, and engagement about an organisational change that the management has adopted. This 'telling and selling approach' is commonly communicated through memos, newsletters, videos, etc., while the participatory approach leverages dialogic

communication to involve most of the stakeholders by asking for ideas and input about the change and the implementation process. This approach is based on the assumption that employees should be active participants in the change.

On the other hand, dialogue, within participatory organisational change, is defined by Raelin (2012, p. 8) as 'the medium through which people seek shared meaning and understanding'. Furthermore, he elaborates that people involved in dialogue listen to each other, reflect upon different perspectives, and are willing to change based on what they learn. Isaacs (1993, p. 25) understands dialogue as an interaction.

> People gradually learn to suspend their defensive exchanges and furthermore, to probe into the underlying reasons for why those exchanges exist… . The central propose is simply to establish a field of genuine meeting and inquiry…, a setting in which people can allow a free flow of meaning and vigorous exploration of the collective background of their thought, their personal predisposition, the nature of their shared attention, and the rigid features of their individual and collective assumptions.

In other words, dialogue helps reveal and change underlying values and assumptions. Similarly, Senge (1997) also argues that dialogue fosters organisational learning through a deep understanding of different points of view.

The third main aspect of participatory organisational change is participation, understood as a horizontal process of knowledge exchanges, which entails an active and horizontal exchange of ideas. It requires an intentional creation of the spaces where participants feel comfortable and safe to express their views, experiences, feelings, and concerns (Hinthorne & Schneider, 2012).

Participatory practises enhance empowerment, positive employee attitudes, motivation, satisfaction, and organisational learning (Argyris & Schön, 1996; Pardo-Del-Val, Martínez-Fuentes, & Roig-Dobón, 2012; Senge, 1997; Sverke, Hellgren, Näswall, Göransson, & Öhrming, 2008) and create a context in which stakeholders (those affected by the change) have a voice and a choice in making decisions (Fals-Borda, 1992; Muller & Druin, 2012).

It is our argument that PBL implementation can be better approached from a participatory organisational change perspective, which will discover and overcome the challenges that the process has for the particular organisation. By taking a dialogical approach to incorporate PBL into the organisational practise, we may avoid the tension of seeing universities as systems that need to be fixed after completing an analysis (normally by

comparing them with PBL universities). One should focus rather on creating the conditions to foster conversations that will increase the awareness of the variety of experiences, knowledge, and understanding within the system (Bushe & Marshak, 2009, p. 360). In other words, this approach provides an opportunity to understand organisational culture and teacher system values and to identify the main organisational challenges.

DISCUSSION

By confronting the data of the Citylab World Café (see the main categories in Table 2) with the literature on PBL implementation challenges (discussed in the previous section), we identified three aspects of the implementation process of PBL in HEIs that can be facilitated through the World Café technique: (1) understanding the principles of PBL by engaging in a constructive dialogue, (2) fostering critical reflections about teaching and learning practises, and (3) changing the organisational culture by promoting sense-making and the construction of meaning.

In Figure 2, we show the relationship between the categories from our data and the main categories found in the PBL implementation literature.

Category	Description
Misunderstandings and different definitions of PBL	There was the belief that theory and practise are two different aspects of learning and, therefore, there was speculation about possible adequate balances (for example 50% PBL and 50% lectures). The same assumption fosters a long discussion about the use of PBL for practical courses, such as studios and theoretical courses. There were also discussions about the definition and understanding of PBL, participants hold assumptions about PBL such as: the students learn alone, PBL is the application of theory, students cannot learn without first having a theoretical base, etc. Some of these claims were not aligned with the theoretical background of PBL.
Change teachers' conceptions of teaching and learning, as well as their relationships with others	There was a clear need to change the teacher's role, competences, and conceptions about teaching and learning. Values, assumptions, and beliefs about the role of the teacher were constantly discussed. Issues such as ego, control, power, and relationship with colleagues and students were explored and discussed.

Change in the structure and organisation of universities	The organisational issues also had a relevant role during the discussion. The following issues were discussed: the need for student and academic staff training, support from the administration, changes in the structure of the curriculum and administration, required time investments, and work and study spaces.
Instrumentalisation of PBL	There was a need for instrumentalisation in order to implement PBL. Participants developed metaphors and visualisations (roadmaps, classification of courses, type of facilitators, evaluation rubrics, etc.) that would help them understand and apply PBL. In some instances, they needed artefacts (plans, procedures, schedules, curricula, etc.) to understand PBL applied in their context.

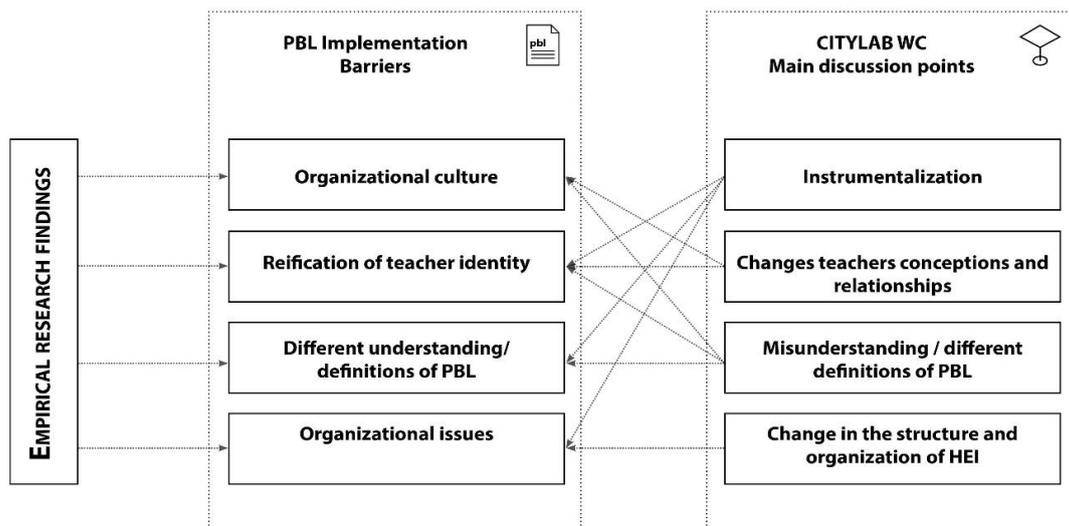*Table 2. Main issues discussed during the Citylab World Café*

Figure 2. Relationship between the CityLab World Café data and previous empirical research

Understanding PBL by engaging in a constructive dialogue

Our empirical data shows that the World Café technique helps to reveal assumptions, beliefs, and understandings about teaching and learning in general and about PBL in particular.

When the different participants joined the Citylab project, a general assumption was that every member had a shared understanding of PBL as a teaching and learning philosophy. However, when discussing the different questions during the Citylab World Café, each member's individual perception and understanding of PBL was revealed. Participants had very different understandings of PBL and its principles (see Figure 3). The diversity of understandings ranged from PBL as the application of theory (practical courses) to an entirely new paradigm of learning. Therefore, these different understandings inform different materialisations of PBL in the teaching practise. For those who understand PBL as a method to apply theoretical knowledge, PBL should only be used in a low percentage of the curriculum, and lecture-based teaching would take most of the curriculum and allow students to acquire the basic knowledge before applying it. Conversely, for those who understand PBL as a way to create situated knowledge, the entire curriculum should be modified, and the traditional teaching and learning paradigm should be reconstructed. These two perspectives were represented in the Citylab project and led to conflict when implementing PBL.
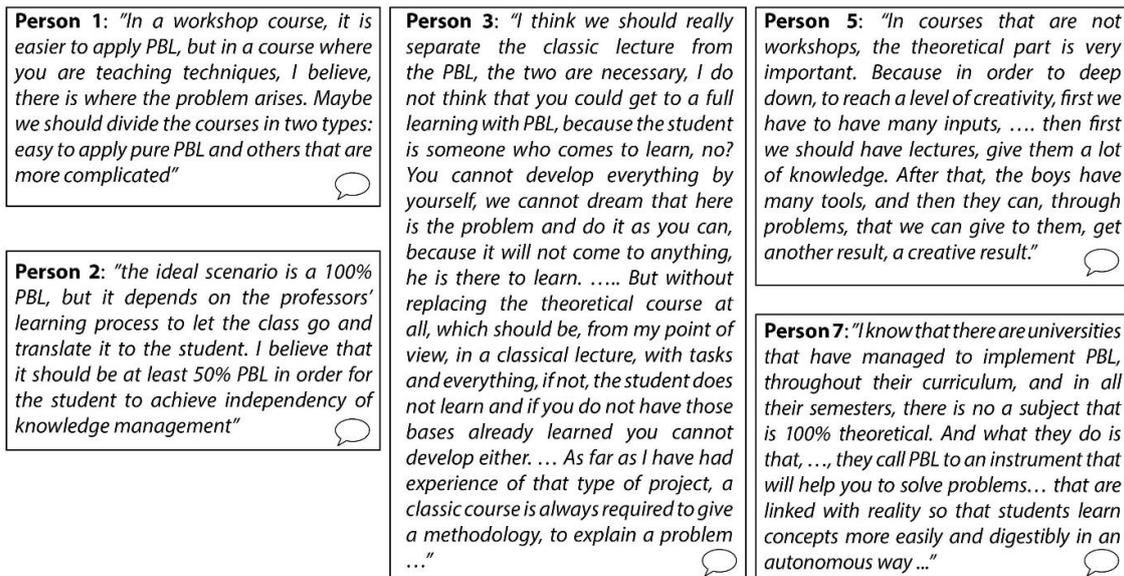
Person 1: *"In a workshop course, it is easier to apply PBL, but in a course where you are teaching techniques, I believe, there is where the problem arises. Maybe we should divide the courses in two types: easy to apply pure PBL and others that are more complicated"*

Person 2: *"the ideal scenario is a 100% PBL, but it depends on the professors' learning process to let the class go and translate it to the student. I believe that it should be at least 50% PBL in order for the student to achieve independency of knowledge management"*

Person 3: *"I think we should really separate the classic lecture from the PBL, the two are necessary, I do not think that you could get to a full learning with PBL, because the student is someone who comes to learn, no? You cannot develop everything by yourself, we cannot dream that here is the problem and do it as you can, because it will not come to anything, he is there to learn. ….. But without replacing the theoretical course at all, which should be, from my point of view, in a classical lecture, with tasks and everything, if not, the student does not learn and if you do not have those bases already learned you cannot develop either. … As far as I have had experience of that type of project, a classic course is always required to give a methodology, to explain a problem …"*

Person 5: *"In courses that are not workshops, the theoretical part is very important. Because in order to deep down, to reach a level of creativity, first we have to have many inputs, …. then first we should have lectures, give them a lot of knowledge. After that, the boys have many tools, and then they can, through problems, that we can give to them, get another result, a creative result."*

Person 7: *"I know that there are universities that have managed to implement PBL, throughout their curriculum, and in all their semesters, there is no a subject that is 100% theoretical. And what they do is that, …, they call PBL to an instrument that will help you to solve problems… that are linked with reality so that students learn concepts more easily and digestibly in an autonomous way …"*

Figure 3. Understandings of PBL, quotes from the Citylab World Café

Many different universities, departments, and schools were represented in the Citylab World Café. Each participant brought their own traits and teaching experience when understanding and interpreting PBL. In the World Café there was no dictatorial definition of what PBL is or is not; instead, it was a presentation of different views that helped make sense of the concept. It was a dialogue, as described by Isaacs (1993), a genuine meeting and inquiry where participants are allowed free expression of meanings and an exploration of their thoughts. The dialogical activity revealed underlying values and

assumptions (e.g. PBL being for practical courses, it being impossible to learn theory using PBL, students needing true knowledge first) that, once revealed, can be explored, discussed, and slowly changed.

During the World Café, people were willing to listen to each other with respect and to hear different perspectives even when they disagreed. This willingness to listen allowed the sharing of knowledge and experiences. It was common to hear examples about how teachers have dealt with the implementation of PBL at the individual or group level, which contributes to the knowledge-creation process. The technique prevents participants from bringing external definitions of PBL and trying to force them into a new context. Instead, the technique fosters the visualisation of the current understanding and the beginning of a shared construction of understanding PBL for the specific context.

Fostering critical reflections about teaching and learning practise
As shown in Table 1, the World Café technique encourages critical and collaborative reflection. We understand critical reflection as the time to step back and examine our thoughts by asking challenging questions. It could also be defined as a process of becoming aware of our actions and values system (Revans, 1998). In Schon's (1983) terms, we may define it as reflection in action (during an event) and reflection on action (after the event). In general, it is an ongoing scrutiny process of identifying the assumptions underlying our actions. The word 'critical' in critical reflection emphasises the ability to be transformative, a kind of thinking that leads to some kind of change (Fook, 2015). Within organisations, critical reflection supports the process of becoming aware of a problem, challenging the leadership, revealing power struggles, and challenging current routines (Thunberg, 2011). Furthermore, critical reflection in organisations depends on participants who are open to thinking together and taking actions (Thunberg, 2011).

If PBL is a learning philosophy that demands students to understand the why, what, and how of their learning, it is only fair that teachers go through a reflective activity to find the answer to those questions as well. We argue that this process is well supported by the World Café technique, which encourages a collective critical thinking. During the Citylab World Café, participants were concerned about the potential of PBL to cover theoretical knowledge (see Figure 3), and they expressed and discussed it collectively. As the activity progressed, they discussed questions about their roles as teachers, the skills that they should have, and the need to create new interactions and synergies with other disciplines as well as with their colleagues (see Figure 4 for quotes revealing these reflective questions/comments).
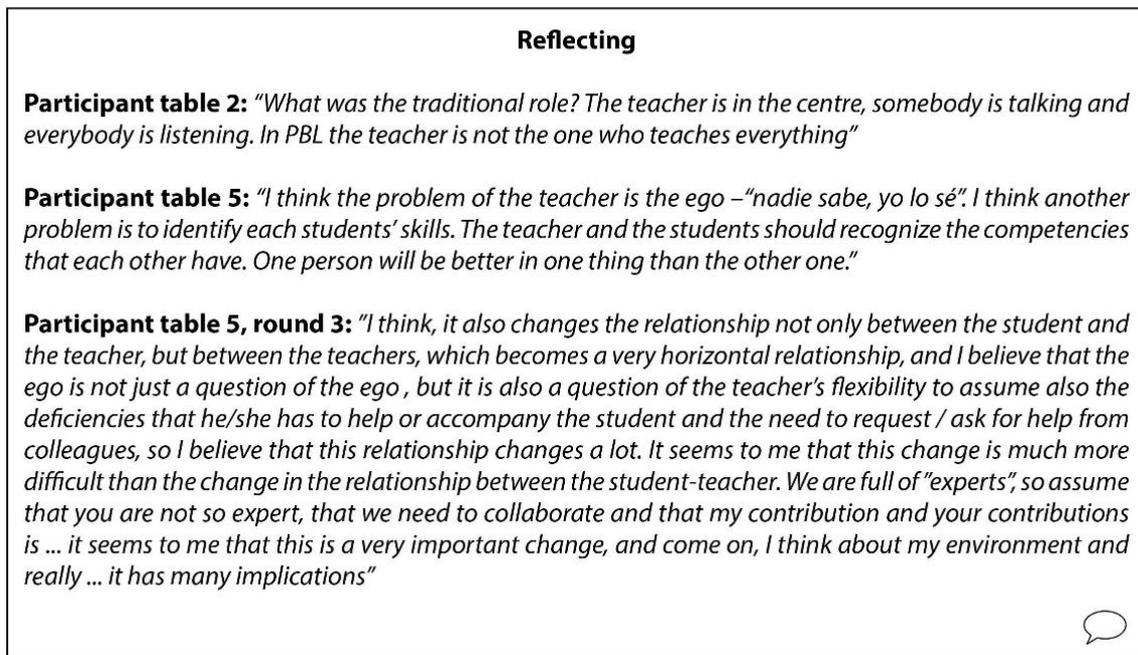
Figure 4. Extracted data from the World Café about reflecting on teaching practices

Tsoukas (2009) argues that through productive dialogue people can review and change their background and create new organisational knowledge. Knowledge creation can be defined as a spiral process of interactions between explicit and tacit knowledge (Nonaka & Takeuchi, 1995). An important aspect of knowledge creation is the space where the knowledge creation takes place. It means that spaces influence how we interact; for example, it is different to interact in an auditorium than in a collaborative space, such as a Design Thinking studio. Nonaka and Takeuchi (1995) have identified this space as 'Ba'. According to them, the Ba is shared space for emerging relationships where information is interpreted to become knowledge. The Ba refers to the physical space as the mental space. Within other fields, this space has been identified as the 'third space of understanding' by Hall (2014) in her research on indigenous people and as 'third space' by Muller and Druin 2012) in their research on participatory design. We found the World Café creates this Ba, which supports the sharing of tacit and explicit knowledge and the creation of new knowledge.

Changing the organisational culture

The empirical research on PBL implementation deals with the inevitable issue about organisational culture change, which affects the organisation as a whole but also the professional culture of the teacher. We identified the value of the World Café technique to initiate these organisational culture changes. The research of Jacobs and Heracleous (2005) concludes that dialogue as a reflective form in the change process (a) allows

people to critically review and inquire into underlying assumptions of individual and collective mental models (these mental models were revealed during the World Café), (b) fosters the creation of collective language (teachers created metaphors and artefacts to make sense of PBL in their context), (c) encourages shifts in mental maps, and (d) reveals mental models that can be critically investigated and changed. Nevertheless, when we do not have evidence of changes in teachers' mental models, we have evidence of teachers sharing their ways of thinking, which may start the process of discussing why we think in the way we do and eventually allow for a modification of our mental model. In other words, we see the potential of the World Café to create the space to initiate dialogue that may change the values, assumptions, and beliefs of participants, who are representative of organisational culture.

CONCLUSION

This paper tackles the question of how the World Café technique can facilitate dealing with the challenges in implementing PBL in HEIs. In order to answer the question, we identified challenges from the literature and collected empirical data from Citylab World Café. Our review found three main challenges when implementing PBL: change of the organisational culture, a reification of the teacher's identity, and changes in the structure and organisation of the HEIs. Issues related to these challenges were well identified in our data from the Citylab World Café, and we described three specific aspects where the use of World Café would contribute to a successful implementation of PBL: First, it provides the space and the conditions for a dialogue to construct a shared understanding and definition of PBL. Second, it helps reveal teachers' system values about teaching and learning, the conditions to explore and discuss them, and the space for knowledge creation. Finally, it fosters the discovery of the diversity of knowledge, experiences, and concerns within a specific educational institution by approaching the PBL change process from a dialogical perspective instead of a diagnostic one and, as a result, co-creates a new organisational culture based on the principles of PBL.

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Comprehensive Evaluative Perspective of PBL on the Learning-Teaching Process of Architechture in the Universidad Simón Bolívar

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ABSTRACT

The learning process in architecture at Universidad Simon Bolivar is based on confronting students with practical or theoretical situations to let them acquire knowledge about the discipline. The core of this process is on design studio courses, and from the early stages of the program they have to discover for themselves the role of architecture in the creation of spaces. Alongside this design methodology, students are exposed to theoretical, historical, and technical knowledge that aims to complement their skills for their professional future. This paper evaluates the general efficiency of the learning process based on solving problems. The first part describes the application of a problem-based situation in a sustainable urban environment for the Architectural professional. The second part explores similarities and differences among Design Studio Learning(DSL), as it is generally applied, and Problem-Based Learning (PBL). Data about methodology, level of student participation, and results were compared using the syllabus. The comparison between title, competences and objectives shows that these aspects should be addressed differently if using PBL.

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INTRODUCTION

The learning process of architecture at Universidad Simon Bolivar is developed confronting students with practical or theoretical situations to let them achieve elementary knowledge of the discipline. The core of this process is based on design studios, and from early stages they must discover for themselves, with the guide of professors, what elements conform a space. They also explore how those elements could be combined in such manners to distinguish architecture beyond individual preferences. The students are also taught other theoretical, historical, and technical knowledge that aims to complement and complete the spectrum of the desired skills for the future professional. As students progress through their career, problems gain complexity, requiring a deeper level of interpretation. The degree of success of this methodology could be more efficiently assessed in senior years, when students are exposed to different situations and have gained problem-solving experience.

This paper evaluates general efficiency of the learning process through the application of a problem-based situation in a sustainable urban environment. This includes the comparison of the advantages of the methodology in accordance with the curricular design of the program, particular characteristics of the institution, and specific content of each subject.

The paper is organized in two sections. The first part describes the application of a problem-based situation in the scenario of the City Lab Project. The second part explores similarities and differences between Design Studio (DSL) and Problem-Based Learning (PBL).

Both parts deal with a one-year sequence that included three parts. First, a preparation term related to the overall planning conditions of the municipality and the limits between the informal settlement of Petare and La Urbina. Second, a term related to the specific border between the two communities. The last term only targeted Petare.

A CITYLAB MODULE

The topic of this module was the issue of informal city, which allow us to evaluate the integration of different disciplines in a very complex situation, and to achieve a sustainable approach .These spontaneous settlements were developed as part of urban process of large metropolitan areas in Latin American cities like Caracas. Students were

given basic information about the growth process and the potential transformation of these areas into regular city districts.

This experience was implemented through a participative design process between undergraduate students and communities from the sector of Petare Sur. Students were organized in teams and assigned a sector. Each sector had leaders chosen and recognized by its inhabitants.

The case study: Petare Sur, Caracas, Venezuela
Petare Sur is a collection of different neighborhoods or barrios, some of them established in the 1950's. These communities began to settle in the hills around the colonial town of Petare, in the east side of the Caracas's Valley. There was no planning involved in the process of organization except for previous infrastructure and roads that connected the town with the outskirts of Caracas.

The methodology applied began with specific activities in order to understand site conditions as well as community organization, municipal authorities, and professional urban plans or academic studies that were previously developed for the area.

Definition of the problem
Spontaneous settlements in Caracas are characterized by of the geographical conditions in which they are developed, the pattern of occupation of the land, the infrastructure, the architectural solution for housing types, and its community organizations.

Critical urban problems of Caracas' barrios are associated with the density, the lack of appropriate infrastructure and services, poor quality of public spaces and institutional facilities, and severe environmental issues related with water and garbage disposal. Specific social issues are typical for this kind of urban areas where crime and violence have created a sensation of fear for their inhabitants, historically neglected by the state and its institutions. From the economic point of view, they are not integrated into the formal city and therefore there are scarce opportunities for employment or commercial services. Legally, tenure rights are not fully recognized. In some cases, these houses are multifamily residences in which families have invested most of their savings, becoming their only real capital.

Identification of most important urban issues
Based on direct contact with the communities, visits to the site and extensive bibliographical information, students were able to establish the problems requiring technical or institutional solutions. The main problems identified in the first stage of the studio were:

Accessibility and mobility

Due to the steep hills, accessibility and mobility are critical for the inhabitants. In general, the area has been developed intensively since it is located close to the subway, Metro de Caracas, with proximity to two stations, and some other mass transit solutions. The real problem is the interchange from the metro system to regular transportation including formal buses and the intensely used informal jeeps and moto-taxis.

Lack of public spaces

One of the most frequent problems is the lack of public spaces for different age groups. The urban pattern leaves, however, multiple open spaces that are undefined both publicly and privately.

Community organization

The undefined space become a safety problem that communities try to control by incorporating security devices such as gates and fences, establishing clear limits. This tendency helps the organization of the community, conforming condominium blocks—a concept taken from the formal city residential complexes.

Infrastructure and services

The lack of proper infrastructure and services—water supply, poor sewage, bad drainage system, meager public lighting—are typical conditions in barrios. Problems associated with those services are difficult to solve because they depend on a complex institutional structure that communities cannot manage. Alternative community solutions became the basis for some students' projects.

Public facilities

When establishing the conditions for the infrastructure of services such as education, health, sports, recreation, and culture, one of the first conclusions was that some of the facilities were in good condition but not interconnected as a network. Some others were in very poor form or not big enough. Students were asked to evaluate standards for these kinds of services for each sector and to determine needs and possible ways to compensate them.

Risks

One of the most serious problems were risks related with geological and hydrological conditions. Traces of previous disasters are visible and constantly referred as tragedies that could repeat. Most of the vulnerable areas have been indicated in maps and official documents but they were not clearly protected as a sensitive space in which constructions should not occur.

Environmental issues

Some critical environmental issues were detected in many places such as the presence of garbage in areas of easy access and related to the recollection route. Often, areas with potential as green spaces or water courses have become the back of the houses and get polluted by the presence of important amounts of garbage.

Institutional fragmentation

One of the most critical issues is the institutional fragmentation that has an impact on urban management. Not only because there is an inappropriate distribution of responsibilities between local, regional, and national government, but also for political reasons as authorities elected at each level are not ideologically aligned. Therefore, there is an absence of institutional presence or bad coordination undertaking urban plans, actions, and functions.

Analysis process

Once problems were clearly identified, teams had to develop specific site analyses. They had to work simultaneously as a class and as a team, in relationship with their communities. As a class they had to get data from different sources such as academic studies, urban plans, or official projects. The teams had constant meetings with the community and site visits to create proper documentation for the project: drawings, photographs, and models. This allowed them to have a direct perspective of the situation and get familiar with site conditions.

The experience helped students understand the real purpose of an analytical process for specific urban conditions and to look for questions before providing anticipated answers.

Design strategies

The studio proposed several scales of intervention: as a general district; as a collection of neighborhoods, and also as particular places with local identity. Each team developed urban proposals and architecture projects operating at the three different scales.

First scale of intervention

The first scale was an architectural intervention on a small public space under precarious conditions. It was a sort of tactical urbanism strategy, with a place identified by the community and selected with the participation of the students, based on its potential and real problems. Students developed their preliminary ideas that were constantly reviewed by the community, the studio professors, and several consultants. The resulting fourteen projects were presented in a private competition, in front a jury of multidisciplinary experts to select the best five proposals.

Students were able to produce feasible projects based on real needs and opportunities in terms of available materials, human resources, and capacities for their implementation. The projects were presented with videos, images, descriptions, budgets, and schedules. Most of the winning projects were dealing with abandoned areas that became an opportunity to create places for congregation or social interaction.

Jury evaluation was based on the clarity of the design proposals and their feasibility. One of the most important lessons provided by this part of the experience is related to the scale of the problem as something important to be established from the very beginning. The smaller the problem, the easier it would to determine a solution and guarantee its participative implementation.

Second scale of intervention
The second scale was related to the development of an urban plan for the specific sector assigned to each team and community. This included the identification of some specific architectural projects combining strategies for improvements of the urban facilities, as well as the integration of a network of public spaces, connectivity and mobility and environmental issues. The architectural solutions were designed preliminarily.

These urban plans stimulated students to work in teams not only in a specific area but also with other groups representing neighboring communities. Negotiation was a key tool for the coordination of several adjacent proposals, obligating students to consider different points of view about specific problems. One of the main aspects at this scale was the organization of houses into condominium to guarantee a reasonable social structure. The learning process was clear by relating the problem at the first scale as an instrument for understanding the overall area and the complexity of situations at an urban level.

Third scale of intervention
The third scale was related to the urban organization of all sectors of Petare Sur in relationship with the city in order to determine ways to integrate effectively its physical, economic, and social conditions. It included a series of strategies for the intervention of public spaces, solutions to improve the conditions of mobility and transportation, and a network of public facilities for education, health, culture, and recreation.

This scale of the project allowed students to develop full architecture projects for specific sectors of a general plan. These projects were based on the established priorities and related to the previous scale. The notion of phasing became very important for the general plan but also for the specific architecture solutions that were developed as a first phase of the urban strategy.

Objectives for Sustainable Development

Problems identified in the studio were related to the Objectives for Sustainable Development, in particular with objective 11 which intended to achieve cities and human settlements that are inclusive, safe, resilient, and sustainable. The goals and actions are shown in Table 1.

	Objective by 2030	Actions proposed
11.1	*Ensure access for all people to their homes and basic adequate, secure and accesible services and improve the conditions of marginal settlements.*	This objective became critical in order to establish the problem, develop a complete analysis, define an urban and architectural strategy and design some of the projects.
11.2	*Provide access to transportation systems that are safe, accesible and sustainable for everyone and improve the security in transit, particularly by expanding the section of roads for public transportation, with special attention to the needs of people that are vulnerable, women, children, people with disabilities and senior citizens.*	Community indicated accessibility and mobility as the most important problems. The main road system could be improved by organizaing of public transportation and its linkage with the pedestrian network, but many pedestrian paths and stairways are not appropiate for senior citizens and people with disabilities.
11.3	*Increase the inclusive and sustainable urbanization process and the capacity for a participatory planning and management process, integrated and sustaible of human settlements in all countries.*	This became a fundamental goal since community participation was the key element. It would be almost impossible to plan any urban strategy in a spontaneous settlement without the incorporation of the community in all phases of the process.
11.4	*Double the efforts to protect and preserve the cultural and national heritage of the world.*	For the students the notion of cultural heritage was inherent to the community and their cultural, musical or religious traditions. Some of those traditions became an excuse for the development of proposals with impact on the physical conditions.
11.5	*Reduce in a significant manner the number of deaths and affected people by disasters, including the ones related with water and reduce sustancially the direct economic losses related to the internal gross product of the world caused by disasters, with particular emphaiss on the protections of the poor and people in vulnerable conditions.*	This goal was relevant because of the necessary relocation of an important number of houses to prevent the consequences of natural disasters. Additionally Caracas is located in a tropical country with two main seasons, summer and a very intense rainy winter.
11.6	*Reduce the negative environmental impact per capita of cities, paying partiular attention to the quality of air and management of garbage.*	Quality of air was not so much a problem because in Caracas Valley the wind running from east to west cleaning the atmosphere constantly. Garbage disposal is a general problem in the city and more intense in spontaneous settlements. Most of the areas for intervention were left over spaces that are used as dumps.
11.7	*Provide universal access to green zones and public spaces, safe, inclusive and accesible, in particular for women and children, senior citizens and people with disabilities.*	The universal access was considered a fundamental aspect for the designs, particularly at the first scale of the proposals.
11.8	*Support the economic, social and environmental postive links between urban, periferal and rural areas by reinforcing development plan for nations and regions.*	The projects propose agricultural areas, new urban parks, riverfront public spaces and other activities that would improve economic, social and environmental conditions of the community.
11.9	*Increase substantially the number of cities and human settlements that have adopted and implemented politics and integrated plans to promote inclusion, effcient use of resources, mitigation of the climate change and adaptation to it, resilience towards disasters, develope and implement integral management of the risks of disasters at all levels.*	Inclusion was one of the most important goals since barrios have been traditionally neglected by urban planning and are not integrated with the formal city. To guarantee equal urban rights projects provide public spaces, infrastructure and services comparable to the ones in the formal city.
11.10	*Provide support to less advanced countries, even by finnacial and technical support, so they can build sustainable and resilient buildings by using local materials.*	Students were asked to use local materials and solve some of the environmental issues by including recycled elements on their designs.

Table 1: Objectives for sustainable development as were adressed by the projects

Achievement of Learning Objectives

Achievement of the learning objectives was measured through practical interactive activities, individual and group questionnaires, final group projects, presentations, multiple group collaboration and by the performance of all activities in the class and particularly in their close interchange with the community. This was also compared with the design quality of all the proposals at the three scales. Projects and plans were also evaluated by their capacity to solve specific problems and their feasibility for execution. Students' projects covered the majority of the case study´s area and most of its significant problems. The projects demonstrate that good quality architecture and coherent urban plans can improve the quality of life for people in poor communities where the lack of formal institutional strategy for interventions creates opportunities for a participatory design process that can lead to real transformations of their habitat.

Results show different levels of knowledge integration and the difficulty of a significant number of them for correlating the already acquired skills in a practical and conscious manner. This could need a revision of the level of accomplished objectives of the methodology and its relationship with other subjects which don't apply the PBL methodology. Another relevant aspect was the evolution and progressive changes in the students' perspectives about the integration of skills and about the innovative application of previous knowledge.

One of the key elements of the studio was the regular participation of architect Ana Vargas, who was invited as a visiting professor because of her background working with low income communities. Her team from "Tracing Public Spaces" developed a complete analysis of the area in order to define sectors, community leaders and a full map of local actors, requested by the municipality and City Council of Sucre. This work was fundamental, providing a constant link with community members and organizing the design competition.

Evaluation

Evaluation by other professionals took place along the process, including university professors from other departments such as urban planning. Student work was presented on a regular basis to professors of other disciplines to prove their skills in communicating the nature of the problems and ways to approach them to a non-expert audience.

Students also had the chance to interact with experts that have worked in Petare and other informal settlements from both academic and professional points of view. International guests were part of the class structure, giving lectures on previous academic experiences with communities in other countries. The experts also had the chance to visit the site,

meet the community and get to know the projects directly from students that then had the opportunity to explain their problems and solutions in a very analytical and synthetic way. It also allowed students to prove their capacity to express graphically, to identify the most important problems and guarantee appropriate design solutions related to them.

IS THE DESIGN STUDIO ALWAYS PROBLEM-BASED LEARNING?

There are strong similarities among Problem Based Learning (PBL) and Design Studio Learning (DSL) and for some the last is indeed a type of the former (Cennamo, 2011).There is also the contrary position, maintaining that "the design studio is sometimes wrongly assumed as PBL" (Green-Bonollo, 2013). This section explores the similarities and differences of both methods, as they were applied in the Architectural Design Studio at Simon Bolivar University in two consecutive courses, between September 2016 and March 2017. Both courses studied the same site, the limit between the formal and informal city in Petare–La Urbina and shared many students in their fourth year of architectural studies.

The first of these experiences (henceforth DS-1) followed the traditional methodology used at the University. The second (DS-2) was a hybrid proposal based on the Aalborg PBL model. Data about objectives, methodology, level of student participation and results will be compared using both courses' syllabi and the evaluation acts of design courses between 2013 and 2018.

Figure 1: DS-2 Vertical Workshop, USB. January-March 2017

DS-1, with 16 students, corresponds with Design VI; DS-2 was a course with 21 students of various levels, Design VII, VII and IX. Both courses were mandatory as part of the architecture curriculum; in DS-2 the students could choose between two options. Due to conditions not related with PBL, most students preferred the alternative option. As the

students with higher grades can choose first, in DS-2 the average grade (2.88 over 5.00) was lower than average (3.39 over 5.00).

Title

In DS-1, the title shows the thematic and a way of approaching the problem, offering a solution from the beginning. In DS-2, the title is inexplicit, opening space for the students' and local actors'´ participation. This space allows students to search by themselves not only the solution, but also the problem to be tackled. Even understanding the title in DS-1 in its more ample meaning, it conditioned both the look over the territory and the possible solutions.

DS-1	Caracas city. Limits and segregation. The bridge project as solution
DS-2	East of Caracas. Inquiries from the fragment towards a sustainable city project

Table 2: Titles of both case studies

Competences

The contents are pretty similar, almost identical. Additionally DS-2 sets three clear categories of competences showing the aspects the student is expected to develop. The detailed definition of competences allows for more clarity, establishing the methods to reach them, and guides the evaluation of results, not only related to the project proposed but also relative to the competences. The students are then encouraged to develop their own capabilities rather than accomplish the professor's established goals.

The contents were mainly related to specific architecture topics, while the competences were more broadly defined

DS-1	DS-2
• Introduction to urban design, sustainable architecture, landscape, urban morphology and city. • Principles of architectural composition, typology of the building, the conditions of complex programs, and the consideration of diverse variables such as: climate, context, social and environmental aspects. • Development of research capacity and conceptualization of the urban design project. • Development of research capacity and conceptualization of the architectural project.	1. Creativity and innovation • Creative thinking • Team work • Innovation 2. Critical thinking and problem solving • Effective reasoning • Use of systemic thinking • Issuing judgments and decision making • Solution of real problems 3. Communication and Collaboration • Clear communication • Collaboration with others

Table 3: Competences as described in the syllabi

General and specific objectives

In both courses the general objective is dictated by the curriculum, and directly related with architecture's specific skills.

DS-1	DS-2
Introduce the student in the development of urban design projects, understanding the role of architecture and the natural and built environment.	Develop in the students skills to approach the study of architectural problems of different scales of with programs that allow their insertion in complex urban contexts in order to resolve conflicts related to the city and its immediate surroundings.

Table 4: General objective

The main difference is on specific objectives. In DS-1 the more directive approach of the traditional method is evident, with specific operative and theoretical strategies and particular tools for analysis and representation. DS-2 presents two types of objectives: methodological and disciplinary. The first aimed to develop research capabilities in the students, helping them to identify a problem, and the second group is particular to the course.

DS-1	DS-2
• Study the concepts of limit and segregation in an urban environment of varied complexity. • Develop a preliminary diagnosis of the conditions of the Petare-La Urbina-El Marqués urban axismapping the current conditions, problematic situations and potentialities. • Understand basic concepts such as: urban morphology, building typology, public space, mobility, equipment, environment, risk factors, infrastructure elements, social and demographic component, activities, land uses. • Reinforce the capacity to formulate an idea or architectural concept as the generator of a design solution that articulates relationships between building and place, and between place and territory. • Explore graphic and modeling tools according to the concept of a design solution. • Study the concepts of sustainable design, environment and ecology in the urban context. • Interpret an urban environment through mapping, photomontage and collage as tools for analyzing the different geographical, environmental and social variables.	Methodological • Develop the student critical thinking. • Assist the student in the construction of a theoretical framework to understand the problem. • Develop the ability of students to identify project opportunities. • Expose students to a real work environment • Develop the ability to present proposals to different stakeholders, adapting the discourse, graphic resources and arguments in an appropriate manner. • Generate a series of plausible projects that can be used by the competent agencies. Urban and architectural • Interpret an urban context of medium complexity. • Develop the concept of habitat. • Study the notions of sustainable design, environmental issues and ecology.

Table 5: Specific objectives

Methodology

Both DS-1 and DS-2 use the studio environment for theoretical-practical learning. The difference rests in the role allotted to each actor. In DS-2 it is specifically stated which activities and responsibilities correspond to each group, including the external ones, which although were in fact present in DS-1, had no assigned roles or specific mention.

DS-1	DS-2
The methodological approach of Architectural Design VI is in the workshop where the student develops the design project through complementary activities that include: • Theoretical classes and lectures • Group analysis sessions and research exercises • Group and individual workshop practices • Field work and photographic record • Induction in the management of urban design analysis, synthesis and representation tools • Diagnosis of urban phenomena based on the value of pre-existence, the social component and environmental problems. • Development of freehand drawing, advanced expression of computerized drawing and 2D + 3D codes, urban imaginary and iconography, use of references, analysis and urban synthesis in 3D.	<u>Students</u> The role of students in the active search for knowledge is prioritized, synthesizing, for this, all the practical and theoretical training acquired in the architecture curriculum. The workshop should provide a place for interaction, discussion and innovation. By working in groups, students can develop individual criteria as well as common agreements to finally generate group proposals for the selected problem. Students will participate in the processes of self-evaluation and evaluation of the teaching experience. <u>Teachers</u> The role of the teachers will be to assist as facilitators and guide the progress of the course. The participation of professors from other sections and other departments will be arranged, and they may eventually participate as evaluators and external critics of the global experience. <u>Local Actors + Community</u> They will bring the student closer to the particular needs of a community and explore negotiation strategies to establish agreements between actors with interests that are not always convergent.

Table 6: Methodologies

In DS-2, the proposed six step methodology for the construction of the problem (Table 7) is noticeable, based on this definition: "Understanding problem building as determining through question the topic to be investigated, the course is presented as a turf not limited, but open to multiple perspectives, in which the interrogations that may arise are not predefined, but will be proposed by the students and developed in discussions and negotiations between peers, teachers and external interest groups. Therefore, the design studio will be the appropriate space to define the problem and its scope".

DS-2
1. <u>Problem explanation</u>. From a given context the students approach to the understanding of the structures and the underlying mechanisms for their concretion. 2. <u>Problem discussion</u>. In team, the students will debate different points of view on a topic. 3. <u>Problem strategy</u>. Outline of the possible strategies and mechanisms of tackling the problem. 4. <u>Study of the problem</u>. Being a problem of an open nature, students will be able to approach their object of study from different places, theoretical, referential, analytical, perceptive. 5. <u>Application to the problem</u>. The objective is to apply the acquired knowledge to a specific situation within the proposed context. 6. <u>Multiple level problem</u>. Similar to the case study, new questions and inputs will arise as students move forward finding the solution.

Table 7: Problem building process

This aspect was innovative, as DS-1 did not include this approach. More than to guide the students in the problem building process, the emphasis was on the solutions proposed for the students to a given problem, predefined by the professor. DSL tends to make students understand the project not as their own investigation but as an external

commission. This facet has a vital importance in the studio dynamics, as the PBL methodology forces the professor out the center, giving the leading role to the students.
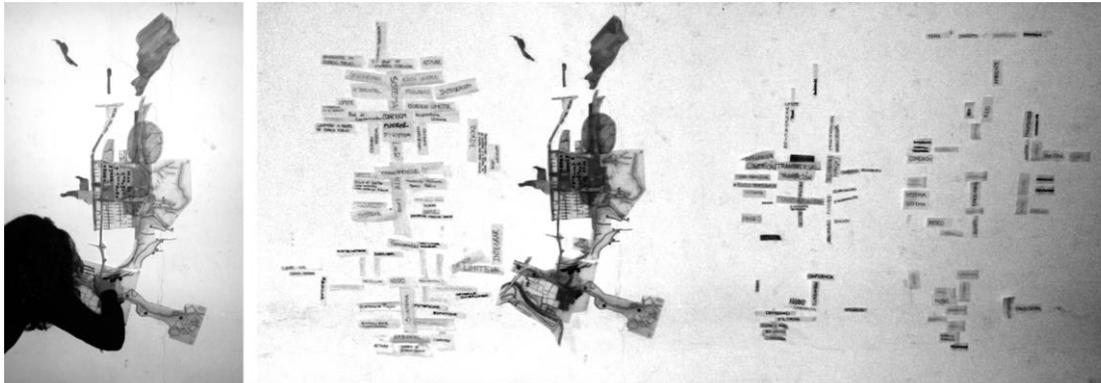

Figure 2: Brainstorming and team dynamic. Problembuilding around the site themes

Process

The process and its stages are the more similar aspect between the two syllabi. In both, an agenda is proposed to guide students work, setting a timeframe, and the differences are subtle. The greater number of stages in DS-1 suggests a more meticulous route, more controlled by teachers. The stages are also more detailed.

Professor		Self-assessment	Actors' assessment	
Product	Process			
70%	15%	5%	10%	
85%		15%		Professor vs other actors
70%		30%		Product vs process assessment

Table 8: Evaluation in DS-2

In DS-1 the relevant themes are defined by the teachers. In DS-2 the students search for themes by themselves. It is worth noting that while in DS-1 the themes were the pre-established frame to approach the place, in DS-2 it was assumed that the themes emerged from the place. As DS-1 was the course previous to DS-2, and half the students in DS-2 took both courses, the structured themes in DS-1 certainly had an influence and facilitated the more flexible approach in DS-2.

In DS-1 the material to be produced in each stage is also more detailed, indicating the specific drawings and their desired scales. In DS-2 the scale of drawings (an indicator of the desired level development of the project and its size) is stipulated only in the last stage.

Dynamics

The relative participation of each actor was estimated based on the activities stated in the

course's 12 week chronogram, assigning a percentage to each actor. In some activities, like brainstorming, team work, site visits, or interaction with community, the students have the leading role, and were assigned a high percentage (90%-100%) of participation. The critiques or lectures were led by teachers, who got the high portion of participation. The normal activity in the workshop was considered as shared by both actors, with 50% assigned to each one of them. A weekly average was calculated for each group. In DS-2 the participation of other actors was also included, such as community and local government officers.

Activity	Students	Teachers
Workshop	50%-60%	50%-40%
Lectures, critics	10%-20%	80%-90%
Brainstorming, site visits, team work, personal work	80%-100%	0%-20%

Table 9: Estimation of the relative participation of actors in each activity

Weeks	Teachers				Students			
	Monday	Tuesday	Thursday	Weekly average	Monday	Tuesday	Thursday	Weekly average
1	100	60	50	70.00	0	40	50	30.00
2	60	50	50	53.33	40	50	50	46.67
3	50	50	70	56.67	50	50	30	43.33
4	50	90	70	70.00	50	10	30	30.00
5	50	90	50	63.33	50	10	50	36.67
6	50	50	50	50.00	50	50	50	50.00
7	50	50	70	56.67	50	50	30	43.33
8	50	50	40	46.67	50	50	60	53.33
9	50	50	50	50.00	50	50	50	50.00
10	50	60	50	53.33	50	40	50	46.67
11	50	50	50	50.00	50	50	50	50.00
12	0	0	90	30.00	100	100	10	70.00
Total Average				**54.17**				**45.83**

Table 10: DS-1 Participation of actors along the term
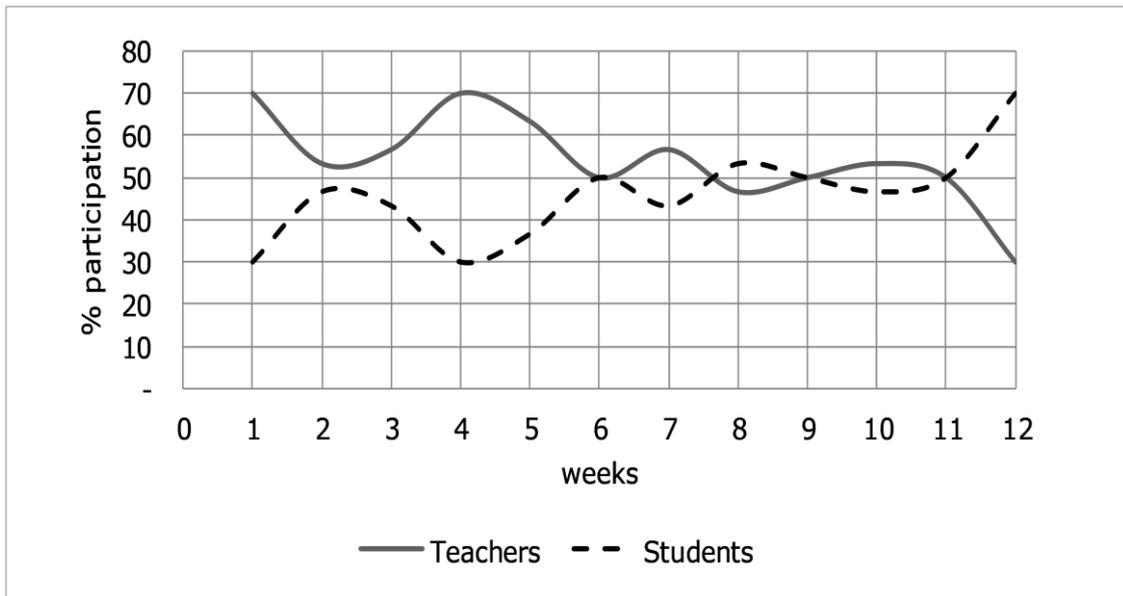
Figure 3: DS-1 Participation of actors along the term, based on data of Table 10

Weeks	Teachers				Students				Others
	Monday	Tuesday	Thursday	Weekly average	Monday	Tuesday	Thursday	Weekly average	Weekly average
1	100	10	10	40.00	0	90	90	60.00	-
2	20	20	0	13.33	80	80	70	76.67	10.00
3	20	10	40	23.33	80	60	60	66.67	10.00
4	30	40	40	36.67	70	60	60	63.33	-
5	30	20	40	30.00	70	20	60	50.00	20.00
6	40	0	40	26.67	60	100	60	73.33	-
7	10	50	50	36.67	90	50	50	63.33	-
8	50	50	20	40.00	50	50	80	60.00	-
9	30	10	50	30.00	70	10	50	43.33	26.67
10	40	20	50	36.67	60	20	50	43.33	20.00
11	10	60	60	43.33	90	40	40	56.67	-
12	0	0	80	26.67	100	100	20	73.33	-
Average				**31.94**				**60.83**	**7.22**

Table 11: DS-2 Participation of actors along the term
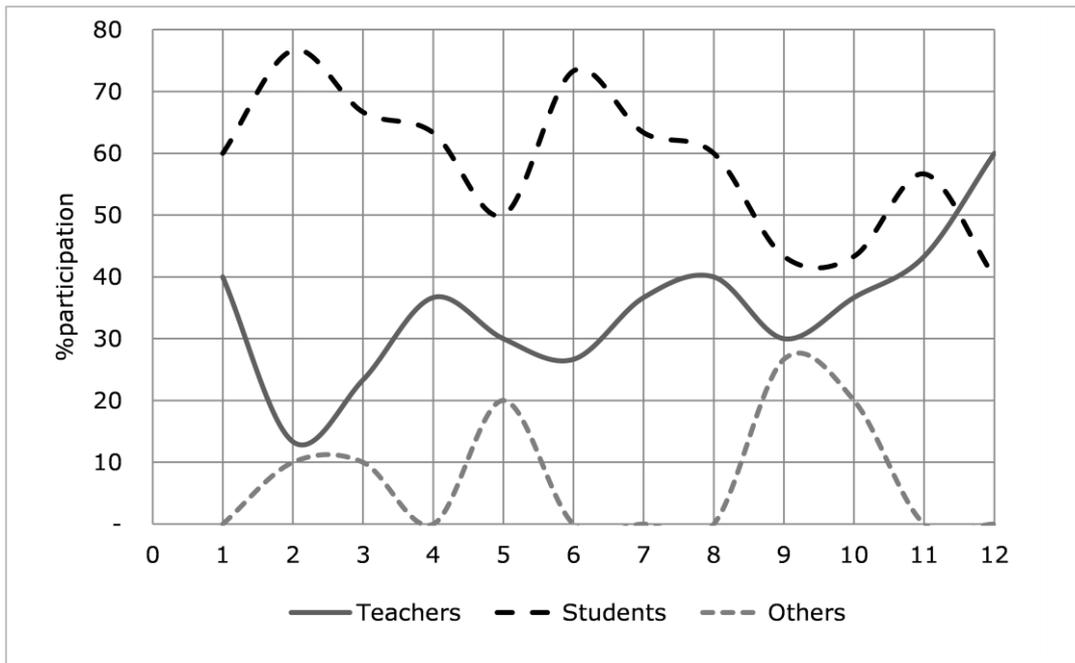
Figure 4: DS-2 Participation of actors along the term, based on data of Table 11

The allocation of participation levels was made based on the time schedule that states the desired dynamics and activities and does not necessarily show actual activities or participation levels during the term. Regular studio sessions, by example, were supposed to be shared by teachers and students, but their relative contribution fluctuated significantly depending on personal attitudes, dedication of students, character of critics and on the moment of the term. Sometimes teachers tend to become more directive near the end of the term if the objectives have not been reached. These subjective differences are difficult to avoid but reaching for goals of higher student involvement and leadership in the chronogram and the syllabus before the course starts, probably help towards a factual decrease of the teachers' participation.

The participation of other actors, such as community and local officers was not permanent, as they shared only in particular activities, such as the site visits and formal arrangement meetings and presentations. However most students went more than once to the site and had a more intense relationship with the community. Even though this participation was documented, it is not easy to measure, and has been dismissed.

Evaluation

In DS-1 the whole of the grades were established by the teachers. It was not stated how much of the grade corresponded to the product (the project) and how much to the process (participation, team work). In DSL the last criteria is always present, but the product is in general appreciated more. In DS-2, both the external actors and the students participated in the assessments, and an explicit part of the grade corresponded to the process. The

professors' valuation and the quality of project is still the determining aspect (70%), but the inclusion of other opinions and criteria allowed assessing factors apart from the designing skills, such as for example leadership, communication or sensibility to urban and social issues.

The product's high weight in the evaluation has nevertheless advantages. The quantity of material, site analysis, models, and drawings produced during DS-1, and used in both courses, would have been difficult to achieve without a strong directive attitude from teachers prioritizing the product. This is indispensable in the very short terms of only 12 weeks.

In both cases a portion of the grades was individual (70% in DS-1, 65% in DS-2), and the rest was in teams. Although teamwork is normally considered a fundamental aspect in PBL, it is also important in traditional DSL.

Results

It was observed that in DS-2 some students, who were weaker designers but strong leaders, demonstrated their abilities and performed better than their personal average. Even if subjective, these observations are valid since in the design studio, teachers and students usually have a very close relationship. The grades of following courses show that for almost every student in DS-2 the improvement was maintained. The DS-2's student with the best improvement, who had among the lowest averages before the course, is highlighted in Figure 5.
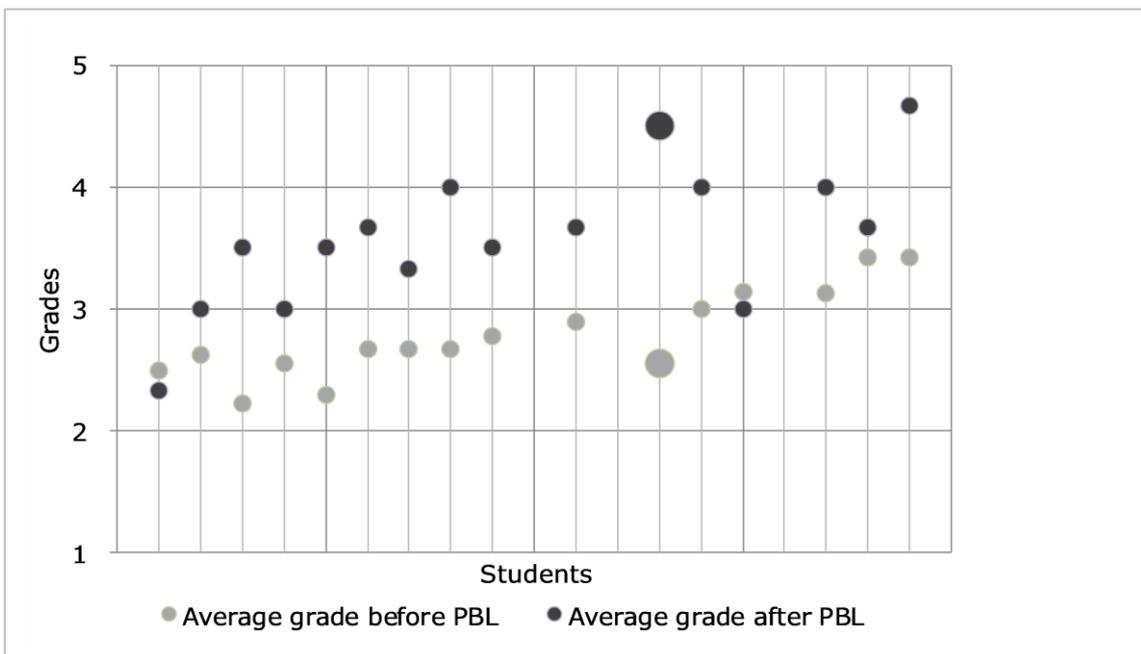
Figure 5: Average grades before and after the PBL courses, by student

In order to validate if there was an actual significant improvement in the grades obtained by the students participating in the PBL model, a brief statistical analysis was conducted. This analysis considered all the grades obtained by the DS-2 students from January 2013 to April 2018; the ones obtained in DS-2, and the grades the same students obtained after.

With this data, a t-test was conducted in order to validate if the differences observed between averages for each stage were statistically significant and could be attributed to

Before	DS-2	After
2.88	3.47	3.64

Table 12: Grades averages for DS-2. Grades over 5 points

the PBL experience. Two-tail T-tests for independent groups were conducted, considering a significance level of 95%.

The statistical analysis suggests that DS-2 students' performance increased significantly after being exposed to this methodology, and that the improvement was maintained after the DS-2 experience.

T-Test		Probability	
1	DS-2 Before Vs. DS-2 After	0.00000	Students from DS-2 experience **increased significantly** their grades after the experience, compared with their own grades before.
2	DS-2 Before Vs. DS-2	0.00631	Average of grades obtained by the DS-2 students during the PBL experience was **significantly higher** than their grades before.
3	DS-2 Vs. DS-2 After	0.47317	The grades' increase after the PBL was **not significant**

Table 13: Analysis of grades average for DS-2 before and after PBL
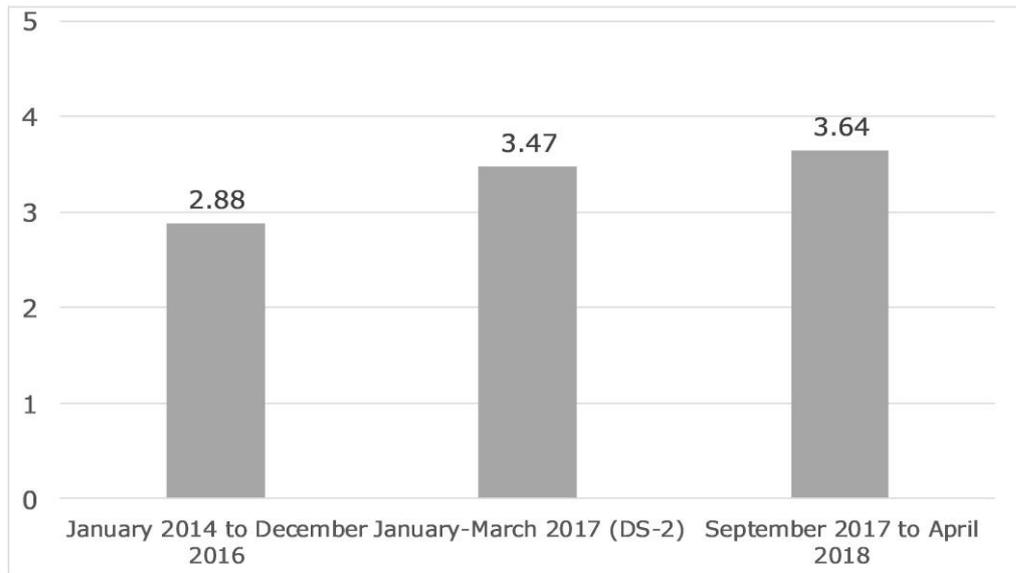
Figure 6: Grade averages for DS-2 (grades over 5 points)

It is also interesting to note the results of the self-assessment, in which each student evaluated their own performance and those of their teammates, in aspects such as initiative, participation, responsibility, creativity and receptivity. For most students the gap between the self-assessment and the view of their team is very small, indicating that, in general, the students were aware of their abilities.

Student	Self-assessment	Team assessment	Final Grade	Difference between self and team assessment	Difference between team assessment and grade
1	3.80	1.80	**2**	**(2.00)**	0.20
2	3.80	2.20	**2**	**(1.60)**	(0.20)
3	5.00	4.07	4	(0.93)	(0.07)
4	5.00	4.53	5	(0.47)	0.47
5	4.20	3.87	4	(0.33)	0.13
6	5.00	4.80	4	(0.20)	(0.80)
7	4.80	4.73	4	(0.07)	(0.73)
8	4.00	4.00	3	–	(1.00)
9	4.60	4.60	3	–	(1.60)
10	4.60	4.60	3	–	(1.60)
11	5.00	5.00	3	–	(2.00)
12	4.40	4.50	5	0.10	0.50
13	4.80	4.95	3	0.15	(1.95)
14	4.20	4.40	3	0.20	(1.40)
15	4.20	4.40	3	0.20	(1.40)
16	4.60	4.87	4	0.27	(0.87)
17	4.40	4.70	3	0.30	(1.70)
18	4.40	5.00	4	0.60	(1.00)
19	3.00	3.60	3	0.60	(0.60)

Table 14: Self-assessment and grades for DS-2 students

CONCLUSIONS

The projects as the result of interdisciplinary work
Participation of students from the architecture and urban planning program and the integration of professors from different departments was fundamental for the success of the experience. The institutional structure of programs and departments helped collaboration and constant exchange among students and professors.

Students were able to play roles in order to guarantee objectivity in the process of discussion about problems, strategies and solutions. Architects might have a tendency to control a process as a leader but they should also be trained to incorporate different technical opinions as well as political, social and economic points of view. This is one of the strongest consequences of a learning process based on problems that are real and critical.

Development of the project has been guided by the students
Students were fully responsible for decision making during the courses. They had meetings between teams and also in large numbers up to the whole class. Professors participated as academic advisors with capacity to give orientation to the problem and to help in the decision-making process.

Most of the students were independent in their meetings with the community and visits to the site which required direct coordination. Some of the students developed a very close relationship with community members and representatives.

Collaborative process with local partners
The challenge was defined in collaboration with several authorities from the Municipality of Sucre. The contact was based on previous academic experiences.

Interaction between students and local partners was constant along the process since the community, organized by different sectors or barrios, was related to the municipal authority as well as other levels of government in the area. In that sense, students became links in between institutions but also with other communities that were working with different students.

Sustainable Cities challenge
Project solutions contributed to the fulfillment of the Sustainable Development goals, and in many ways related to some of the most difficult political, economic, social and cultural

situations. Students went beyond the role of an architect, and farther than in other courses, and were capable of understanding the importance of improving the spontaneous settlements as a tool to solve the poverty. It is then possible to say that the PBL methodology helps to stimulate the formation of sensitive professionals for the future vision of our cities.

Although studio environment was appropriate for a PBL approach, the displacement of professors from the center required considerations regarding objectives and methodologies that are not always present in Design Studio.

Inclusion of those considerations on syllabi were needed but not enough; the attention towards keeping the professor's role merely as a guide, and inclusion of other stakeholders should be maintained throughout the course.

Data suggests that using PBL in design studio seems to improve the performance of students and it would be interesting to conduct more extensive statistical analysis among grade averages of students exposed to this methodology and others who did not have the same experience.

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Academic Performance of Students of Urban Design, Applying Problem-based Learning (PBL)

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ABSTRACT

The urban design courses of the urban planning career in the Universidad Simón Bolívar (USB, 2017) Caracas-Venezuela, are part of the backbone of workshops (4 of 11) and invite to the study of parts of the city whose problems demand to be resolved, according to traditional teaching methods.

Considering this precedent and within the framework of the Citylab project (2015-2018), the Problem Based Learning (PBL) is implemented in Workshop VI, during the last quarter of 2017; and then a questionnaire is given to the participating students to know their opinion on the following points: their role in this process of building knowledge, and their appreciation about both the exchange with local guests-actors and this new methodology. The respondents conclude that in the face of the traditional method, the PBL promoted capacity building for critical analysis, teamwork and consensus building against the city's complex problems.

Keywords: Academic performance, Problem Based Learning, Urban design courses.

A DESCRIPTION OF CONTEXT

The urban planning career (1975) at the Universidad Simón Bolívar is structured by academic year (5 years), taught under a quarterly regime with 68 courses (basic and professional cycle) that are grouped by thematic areas or chains. One of them corresponds to urban workshops (a total of 11), which are present in each year of the professional cycle, covering physical-geographical issues, urban design, roads, urban dynamics, formulation and evaluation of plans and projects; complemented by theory courses.

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Consequently, urban planning workshops constitute their backbone and the space for teamwork in the study of the city, par excellence; and particularly those linked to urban design, which represent four of the total (from workshop III to VI).

However, the professor assumes the role of director of the process, responsible for the transmission of information and evaluation (oral presentations); using the theory-conceptual management, group work (maximum four students) and the support of proposals of urban intervention by students; with limited feedback from key players and professionals/students from other training areas, considering the short quarterly regime.

Taking into account this condition, it is decided to select workshop VI, corresponding to the end of the 3rd year of the career, as the pilot course to the application of the PBL methodology, during the quarter September-December 2017 (12 weeks); in order to analyze the potential impact of this methodology on the development of participants' capacities and possible applicability in other courses.

The workshop VI introduces students to the main elements for the design of urban regeneration proposals, under sustainability criteria and based on the identification of their problems at intermediate scale. It involves 12 students and 2 teachers responsible of the course, and plans the invitation of 8 teachers from other areas and some students of architecture and urban planning, to facilitate multidisciplinary exchanges during specific class sessions.

THEORETICAL AND PEDAGOGICAL FRAMEWORK

In face of the challenges of 21st century higher education, which involves raising global needs around the skills that new professionals require to meet the complex challenges of the world, including cities; it is essential to promote inclusive, interdisciplinary, creative, innovative and critical learning (Scott, 2015); to strengthen their research and information synthesis capabilities for the development of solutions.

In front of this panorama, it is convenient to review the traditional teaching, where the teacher acts as the main learning's motor of the students. An approach that according to Rodríguez (2013):

> *Is eminently expository, the evaluation of learning is reproductive, focused on the qualification of the result, the teacher-student relationship is authoritarian, is*

based on the conception of the student as a receiver of information, as an object of knowledge (p.4).

It is interesting to consider the Problem Based Learning (PBL[i]) as a strategy of teaching and learning, supported by discovery and collective construction of knowledge. It seems to encourage the student to appropriate the process and the collection, organization and selection of information (Restrepo, 2005); to solve the identified problem.

In this regard, problem-based learning has several meanings, from pedagogical approach, method, technique and learning strategy. In this sense, to Barrows (1986) in Morales and Landa (2004) and Savery (2006):

- It is a learning method that takes a constructivist perspective. It is focused on the student, based on the use of real problems as starting point to enable the student acquire, integrate and build new knowledge to solve the problem.
- It is a learning method that empowers students to carry out research by integrating theory and practice. It suggests that the selected problem must be aligned with the learning objectives, link the student's prior knowledge with new ones that are expected to be learned, must be complex and require an interdisciplinary approach that challenges and motivates the student. Furthermore, PBL allows analyzing and discussing a phenomenon, recognizing and accepting different interpretations (Savery, 2006).

Therefore, PBL is a "complex and dynamic" process integrated by stakeholders (academic staff and students), structures (curricula and facilities) and frameworks (content and evaluation) (Guerra et al, 2017, p.219); where learning objectives (holistic and interdisciplinary) are the ones that leading to problem design (Stinson & Milter, 1996).

Consequently, and within the framework of the European project Citylab (2016-2018), to advance on the application of the PBL in the urban workshop VI, during the quarter September-December 2017, it was necessary to make a prior adaptation of the Aalborg model as detailed in Figure 1.
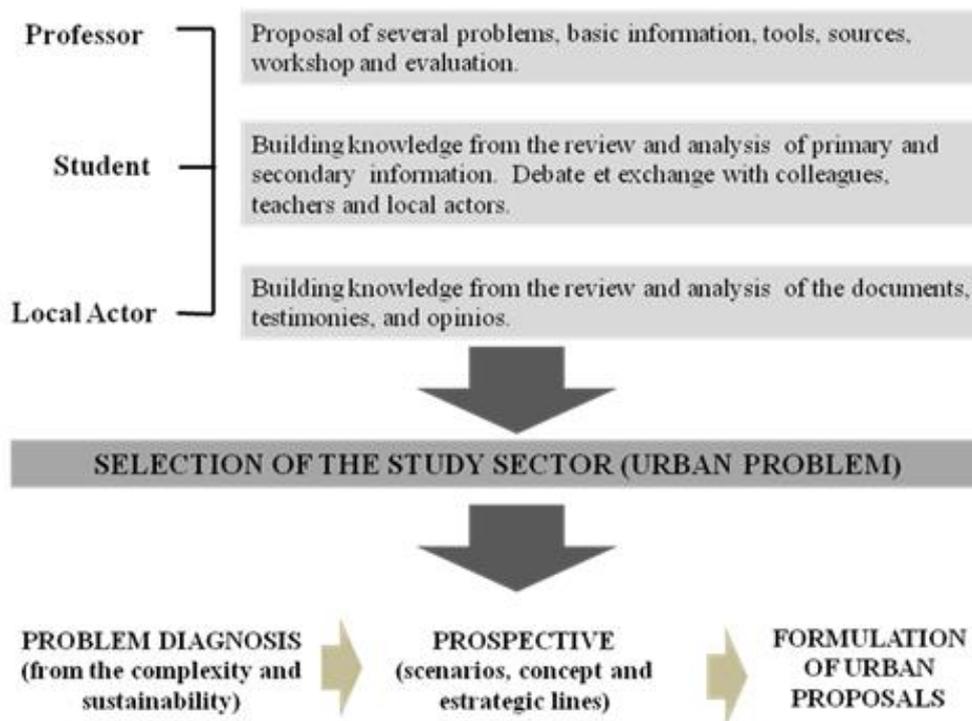
Figure 1: Conceptual framework used for the Urban Design Workshop VI. Source: Developed by the authors. 2018.

So, the real problem is an urban sector, the protagonists are the students, and the facilitators are the teachers.

Finally, this exercise carried out by teachers is evidence of its paper in the redesign of learning spaces and their measurement. Also, they participate in the promotion of innovation and creativity in face of current challenges; in the framework of INTEF's Horizont (2017) report.

CONCRETE IMPLEMENTATION AND ACTION

In order to analyze the impact of the PBL conceptual framework (figure 1) in the urban workshop VI, during the 24 class sessions (2 sessions per week and 4 hours per session); at the level of the capacities development and participants paper; the following process was implemented:

- **In the classroom**: the teachers of the workshop VI presented, during the first session, the course planning to the 12 students, organized in theoretical and practical classes, teamwork, definition of the case study, exchange with guest professionals/teachers

and visits to the problematic sector. The students were invited to be freely grouped into teams of four members each. The actual urban problem was chosen by students from three options previously selected by the teachers responsible of the workshop. Similarly, the specific exchanges with students of workshop VI and others of architecture and urban workshop IX (4th year) were held during the practical classes; whereas in the theoretical classes, the exchange took place with eight guest professors from different professions (urban planning, engineering, architecture, geography and sociology), who would provide knowledge focused on the problems identified in the study case.

- **In the urban sector**: several visits were planned, in order to obtain information related to the problems, needs and concerns of the resident community. Likewise, different local government units were consulted, with the purpose of collecting information about the case and existing urban intervention studies and/or proposals.

This allowed the students of the urban workshop VI to identify the main study case's problems, supported in the secondary and primary information. Likewise, the formulation of a first approximation to urban design proposals.

This initial proposal was subjected, in the classroom and in two opportunities, to the strategy of the World Café or Workshops (photo 1 and 2), to encourage the debate among the students participating in the urban workshop VI.

Photo 1 and 2: World Café or Workshop, Workshop VI. Source: Taken by the authors. 2017.

This strategy consists of the initial participation of one member per group, in order to explain their urban design proposal; which is followed by the rotation, every 15 minutes, of the others member's teams; until everyone knows the proposals of the different groups, generates opinions or contributions about it, and returns to their home group.

Consequently, it promotes the expansion and strengthening of students' knowledge from a collaborative approach and facilitates the formulation of final proposals.

The result of work carried out in the classroom and sector studied was presented orally by each group of workshop VI, accompanied by plans, models and portfolios delivered digitally; all of them in front of the guest teachers and within a scheme of validation of acquired knowledge. Both the process and the final result were taken into account; as well as the orderly communication skills expressed in a clear and concise manner (Branda, 2009). Finally, the student self-assessment was also used.

Once the learning experience under the PBL method was completed, a questionnaire was given to the 12 students of workshop VI, structured by 10 questions (open and close types) associated with the recognition of the student paper, the appreciation that the student makes about exchanging with guests and local actors, their qualification of the application of the PBL (utility, complexity, dedication, group work, communication and contribution in the development of new skills), and the possibility of replicating the methodology in other courses; and the results achieved are presented below.

RESULTS AND REFLECTIONS

Once the responses given by the students of the urban workshop VI were processed, the following results are highlighted:

- All course students (12) reported conducting a previous documentary review, visiting the study sectors and making contact with local actors.
- 9 students out of 12 students says that meetings with local actors helped them understand the real needs of the community, identify structural problems, and move towards feasible solutions.
- The totality of the student (12) ensure that exchanges with students of architecture, urban planning and guest teachers of various specialties provided a contribution to their performance in the course.
- 7 students out of 12 students argues that the PBL methodology promotes research, debate and new approaches to knowledge.
- 4 students out of 12 students ensure that the implementation of the PBL requires strengthening leadership and time management skills.
- 8 students out of 12 students considers that the products generated were built by themselves, while 4 students says they were developed among students and teachers.
- On a maximum rating scale of 5 points, students recognize that the PBL demands greater dedication (4.9/5), teamwork (4.81/5) and communication (4.72/5).

- 8 students out of 12 students considers the application of the PBL in other courses included in the career is feasible and desirable, but recognize that a prior preparation must exist.

As shown, the impact generated by the implementation of the PBL conceptual framework in the urban workshop VI can be considered favorable, exceeding by more than 60% (7 students out 12 of students) the positive responses around the multidisciplinary and collaborative work involved. It does not appear to have meant an obstacle the exchange with other students and guest professors, or with the actors involved in the study case; and neither the searching and processing of information. Perhaps, the workshop mode, typical of the urban planning career from its origin, facilitated the performance of the participants.

Likewise, the most claim that the PBL method was useful in strengthening their capacities of critical analysis, teamwork, communication, and building consensus against various interests. They also achieved new forms of knowledge about urban design, derived from interdisciplinary meetings and the argumentation of its work.

However, students emphasize and recognize the need to strengthen certain soft skills or competencies, in order to take advantage of this type of methodology; such as: leadership, time management and effective communication strategies; which helps avoid resistance to change.

Thus, the PBL demonstrates a potential to the improvement and updating of the teaching process according to the needs of the 21st century. From the point of view of the scope of the learning objectives of workshop VI, the interdisciplinarity required the inclusion of additional theories, according to the problems identified; within the framework of a short academic period (quarterly), typical of the USB.

In this way, the teacher training in PBL is essential to achieve the new trends of collaborative learning. This condition demands a necessary revision of the academic program to achieve a balance between the scale of the problem to be studied. Equally, the thematic scope of the courses and the skills proposed to strengthen in the students.

Therefore, the challenge is to communicate and spread this experience results, and to generate teaching and learning strategies for the knowledge society.

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[i] It emerged in the late 1960s, initially applied at McMaster University in Hamilton, Canada (Dueñas, 2001) for the study of medicine, then at Case Western Reserve School of Medicine, Cleveland in the United States; spreading to different educational institutions in Europe, the United States and later in some of Latin America.

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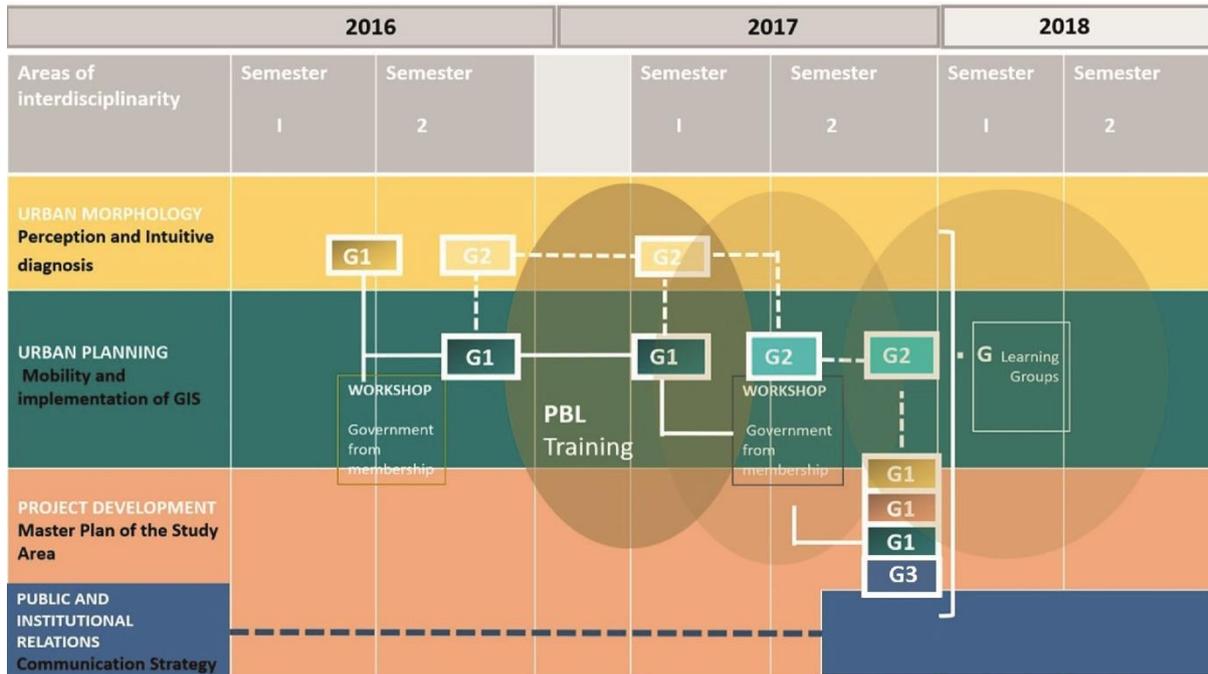
Fig.1: Scheme that details the sequence of actions according to the academic areas and the allocated time for each stage. Team staff elaboration.

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
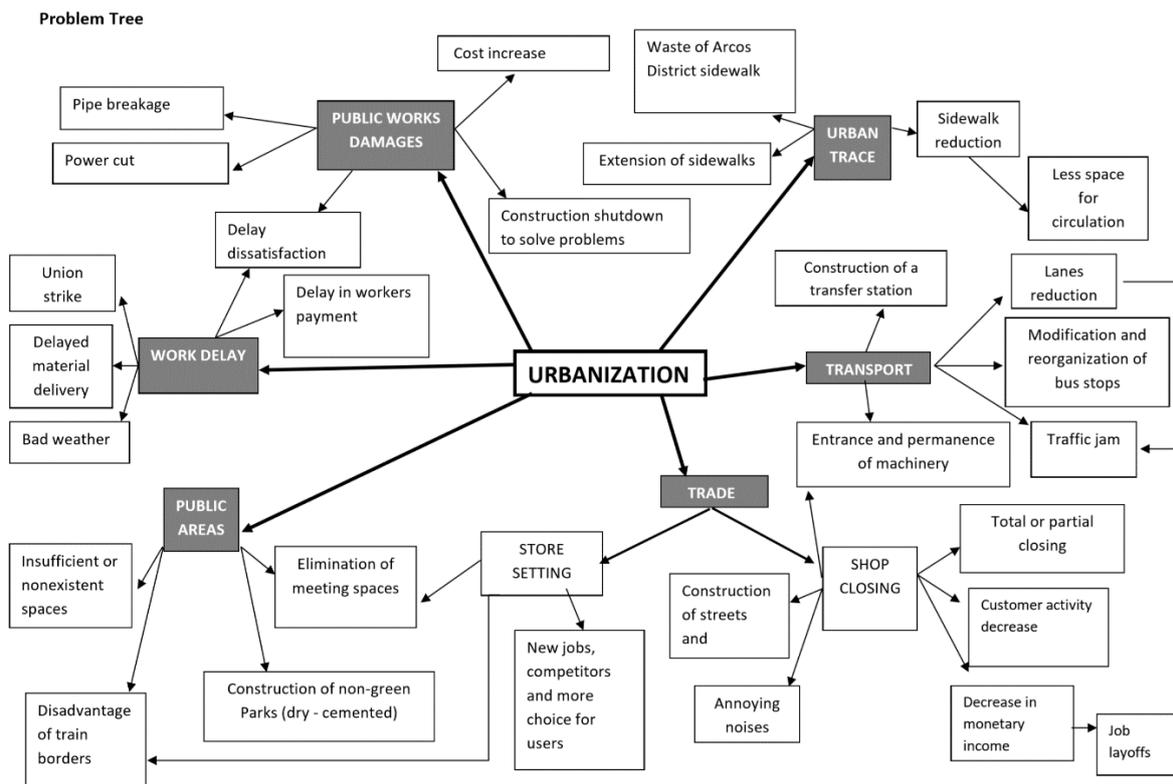- Courses of action for each issue
- Map of audiences to work with

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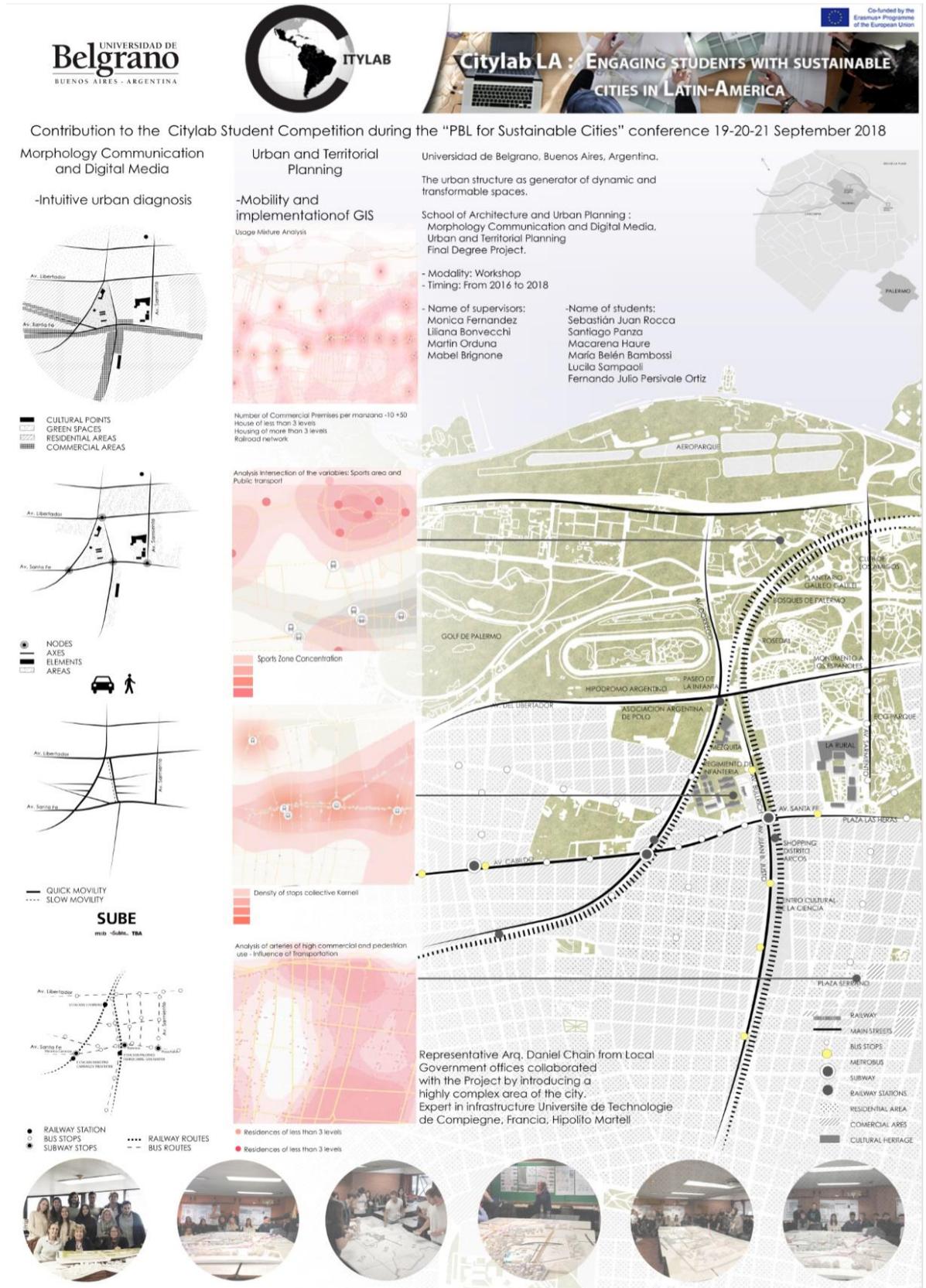
Fig.4a: Results Project elaborated by students for CityLab Final Conference contribution

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

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The Crowdmapping Mirafiori Sud Experience (Torino, Italy): an Educational Methodology Through a Collaborative and Inclusive Process

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ABSTRACT

The CrowdMapping Mirafiori Sud (CMMS) pilot project, carried out by the Polytechnic of Turin (Italy), involved the academic world (students and professors), the Mirafiori Onlus Foundation, the local administration and the community in a participatory and inclusive process. The district is a large area of Turin characterized by a high average age of its inhabitants and a high percentage of foreigners. The aim of the project is to identify and report, through the use of ICT, the obstacles that prevent residents - the most vulnerable categories - from using public space. In the start-up phase, it was not born as a PBL approach, but during the application the PBL was considered a development perspective in the educational experience starting from the students' proposals and the exchange of their skills, in the specific declination of the PBL approach known as community engaged learning. For students, this version of PBL has proven to be strategic in the implementation phases of the project, in particular in the mapping of interested parties and the data set and connections between networks of actors.

1. INTRODUCTION: THE LITTERATURE BACKGROUND

The well-known and consolidated principles of the PBL (De Graff & Cowdroy, 1997; De Graff & Kolmos, 2003; Ertmer & Simons, 2006; Haan, 2006; Hannafin, Hill & Land, 1997; Kolmos, Fink & Krogh, 2004; Lehmann, Christensen, Du & Thrane, 2008; Moust, Van Berkel, & Schmidt, 2005; Savery, 2006) have been applied and tested from a specific perspective in the teaching experience that we want to illustrate here. The project was in fact the subject of experimentation of the PBL approach in a perspective of development in the educational

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experience and also reasoning about the different roles of the teachers in orienting the problems in a multidisciplinary perspective. This application saw the PBL approach born on going with the training process and not, as usual, setting the PBL process *ex ante* as a learning mode. In particular, as Dahlgren, Castensson & Dahlgren (1998) assert, if both perspectives -a learning perspective or a teaching perspective- are taken in the development process, it is necessary to clearly define all the characteristic of the learning perspective: the learning process of the students and the two teaching perspectives, the supportive role or the directive role.

In the case of CrodwMapping Mirafiori Sud (CMMS), not born as a PBL approach (Section 2), all perspectives emerge in the project construction process, in which the students' activity, responsibility and influence on the education have emphasized and in which the supportive tutor's role have mainly focusing the group process, while the directive tutor's role have characterized by a restricted view or uncertainty of the teacher's role in PBL.

The perspective of this article, as stated by Hage, Leroy and Petersen (2010), sees the PBL approach emphasizing also society's active role in knowledge production, called the 'social learning' approach: thanks to the direct involvement in a real process, the students and teachers, relating to the stakeholders, are entitled to participate in the production of knowledge that regards them. Emancipatory aims are concerning processes of mutual learning, creating networks of expertise, and supporting less privileged groups (empowerment).

For the Italian debate, among the multiple contributions we mention Lotti (2018), Cantoni & al. (2018) and De Marco (2018), as the PBL approach is also re-read through the strategic role of multimedia technologies and learning such as Experiential Learning. For the CMMS the development perspective of the PBL in the educational experience has seen its declination in particular: 1) in the structuring in progress of the teaching strategies according to the "constructivist" inspiration (Rotta, 2007) of the Project Based Learning; 2) for the aspect of Service Learning (SL) or in-service learning, a theme emerging in international literature (www.europeengage.org) in pedagogical research. This particular focus is closely linked to the CMMS process, since the experiential learning has been combined within the curricular path, with the active engagement in the community (service) of students who relate with local stakeholders for community development: this is the well-known community based or community engaged learning (De Marco, 2018). On the basis of these premises, the contribution is divided into the following parts: the description of the case (paragraph 2) and its objectives and expected results, followed by its rereading according to the PBL perspective of development of the educational experience in the two meanings previously mentioned. In paragraph 4 the results are highlighted in light of this perspective and, finally, some future prospects of experimentation are traced.

2. THE CROWDMAPPING MIRAFIORI SUD EXPERIENCE (CMMS), TORINO, ITALY

The pilot project CMMS, carried out by the Politecnico di Torino (Italy), involved the academic world, students and the local community in a participatory and inclusive process. The genesis of the project did not include the application of the PBL approach and was focused on learning and involving a team of students on emerging issues of social innovation and collaborative processes. Social Innovation (SI) is a very broad concept and a domain in which many parties are studying development trajectories also in terms of innovative training methods and research dissemination. It is in this sense that the PBL approach was seen as a new experimentation perspective. Project Based Learning was applied in the evolution of the project and focused in this case: 1) on design through the Web Quest, which consists in starting from a search for online resources on a real problem by designing a critical presentation of the results obtained selecting the information; 2) on the use of new technologies; 3) on learning based on the close relationship between the development of skills and problems or teaching for problems (problem based) and the value of authentic learning for the development of citizenship and civic skills (Table 1). In CMMS one of the learning models was to encourage students to participate in the project activities by meeting the real needs of the community.

Learning Outcome	Definition	Sample Measures
Understanding Social Issues	An individuals' frame of reference that guides decision making in terms of complex social issues.	Diversity and cultural awareness and sensitivity; perceptions of homeless, elderly, disabled, different races or cultures; ethical and moral values and decision making; interpersonal skills; **understanding of the needs of the community; understanding how to help the community; a desire to engage in future service activities in terms of both a feeling of responsibility and a commitment to do so.**
Personal Insight	An individual's perception of self.	Identity; awareness of oneself in terms of strengths and weaknesses; career aspirations; self-efficacy; self-esteem; determination; persistence.
Cognitive Development	Task and skill development and academic achievement.	Management skill development; writing skills; problem-solving skills; critical-thinking skills; GPA; course performance.

Table 1. Learning Outcomes of Service-Learning (Yorio e Ye, 2012, p.11)

Many people recognize social innovation as a sustainable choice with which we can change our current societies, in a more democratic, sustainable and inclusive world. Social innovation addresses the creativity and needs of its citizens where the structures and rules of the system are unrecognizable, although formally democratic. Ideally, through social innovation we will be able to build a more democratic, sustainable and inclusive society. Given the above, the project was born as an educational experience and supported by funds for student activities. The work was conducted by a group of students and professors (30 students of master's degree courses in architecture, design and engineering, 3 doctoral students or doctoral students, 2 post-graduate fellows and 2 teachers) with the Mirafiori District, the Foundation of Mirafiori Onlus, local population and associations, with particular attention to the most exposed and vulnerable categories in terms of accessibility and usability of urban spaces. In the start-up phase it was

not born as a PBL approach: in fact, it was born as an educational experience that started from student projects and the exchange of their skills, but during the experimentation the PBL approach was identified as strategic for the aspects of problem solving in the phases of stakeholder mapping, research of data sources and data processing, in the identification of relationships and roles between networks of subjects and in the direct involvement in the process of interaction with the Public Administration. The educational experimentation in the "learning by doing" workshop has allowed the students to approach the theme of collaborative platforms and to decline it according to a problem solving approach: the team of 30 students, coordinated by 2 supervisor teachers, thanks to the articulation in groups of work for skills, during 6 months - both in the classroom and in the premises of the district and during inspections - have proposed high-tech solutions (*on line* modality) and solutions that allow to bridge the gap due to the digital divide of the population elderly or with mobility difficulties and with aspects of disability (*off line* modality). In fact, Mirafiori Sud is a vast area of Turin characterized by a very high average age of its residents and a high percentage of foreigners and by a strong proactivity of its inhabitants, thanks to the presence of a rich network of associations.

2.1 The aim, the context and the phases of CMMS

The aim of the project is to identify and report, through the use of ICT, the obstacles that prevent residents from using public space in their district. The information collected, processed and classified is made available through an online platform. Citizens, especially the most vulnerable (ie the elderly) are active subjects: they are asked to report problems and proposals, thus fueling a process of participation.

The perspective of the PBL approach has emerged as strategic on the part of the responsible teachers and coordinators to structure and plan the learning phases of the students in the process of involvement from below of citizens and interaction with public decision makers. In particular, from a preliminary phase of listening to citizens and neighborhood associations about their needs and their reporting on aspects of care of public spaces in the neighborhood, students had to face the reporting phase of this information and that of translation of qualitative data into thematic categories and into proposals also through the use of technology (development of encodings for digital platforms, social networks, sites, etc.). This passage highlighted how the PBL approach was strategic, in particularly from the theoretical-cognitive phase (knowing it) to that of the search for both technological and conceptual solutions through technical-operational learning (knowing how). Students also developed self-learning skills in connecting a large amount of information and knowledge to develop new ones. In the CMMS the key aspects of the participatory process were analysis, research and learning by making, strategic phases of the knowledge process. The perspective of PBL has emerged as interesting also in the process of involvement and learning of students in the demonstration phases of the use of ICT and crowdmapping during "transect walks", of data collection and their analysis and listening and comparison with all stakeholders.

The project was developed in two different phases. The first phase (2013)- this CMMS- is the pilot project to recognize the context and specify the method. In this phase, the PBL learning perspective focused, as previously underlined, in the preliminary phase of knowledge and translation of the needs of citizens, in the phase of presentation by the students of interactions with citizens (through interviews, data collection, supporting in the use of smartphones, etc.) and comparison with PA managers. Furthermore, under the supervision of the responsible professors, they developed the ability to draft the budget and translate accounting items into the project's expenditure items: this aspect was requested at the end of the workshop for the allocation of funding from the Polytechnic of Turin. The second phase (2015) -called the MiraMap project- started after winning the SIforAGE award, which provided innovative solutions to make citizens interact with the public administration, focusing in particular on the needs of older people.

CMMS was created with the aim of identifying and communicating, with the participation of residents and thanks to the use of new technologies, the obstacles (physical and cultural) that prevent residents from taking advantage of public space in the Mirafiori Sud district: the informations collected, processed and classified are made available through an online platform. Citizens, especially the most vulnerable such as the elderly, are an active part: they can report problems, proposals and even things that work well in their district, thus fueling a complete and transparent participation process. The project was conceived with the aim of generating a pilot experience that can be replicated in other parts of the city.

3. RESEARCH METHODOLOGY, PEDAGOGICAL FRAMEWORK AND ANALYTICAL TOOLS: THE PERSPECTIVE OF PBL APPROACH IN CMMS

The tool used for the project is the crowdmap, an open source platform designed and created by the Ushaidi team, a non-profit organization in Nairobi, aimed at collecting information collectively. The software offers tools that allow people to send information, using mobile phones or the internet, creates a temporal and geospatial archive of events and subsequently transforms the information collected into points on the map. The crowdmap is based on a participatory process: no longer a top-down action, imposed from above as a simple statistical study of a territory, but an approach that identifies people (the crowd) as the essential element for creating the map.

The CMMS is online and is available for residents and public decision makers. It is currently being implemented with the MiraMap.

The didactic planning phases of the CMMS process finds some consonances in the structure set out by Cantoni, Setti, Mosconi, Wang (2018, p. 3, Figure 1).
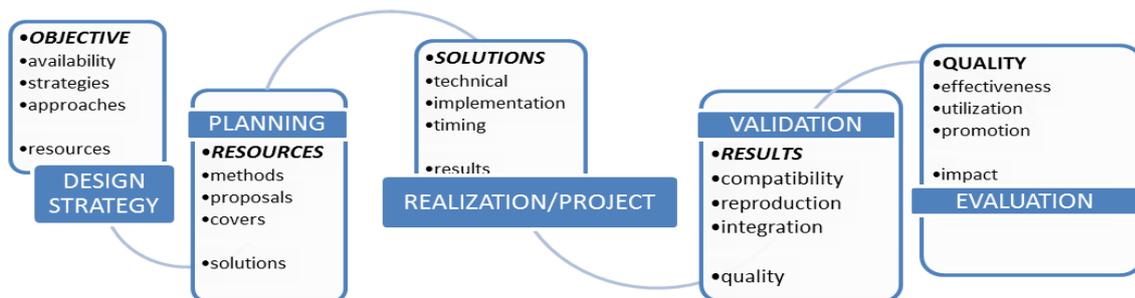

Fig 1. The five phases of realization of the process of problem based learning flipped classroom by Cantoni, Setti, Mosconi, Wang (2018). Source: *Author's translation by Cantoni, Setti, Mosconi, Wang (2018, p. 3, Figure 1)*

As reported in the Introduction, the PBL perspective of this real case is the process known as *community engaged learning.* The centrality of the issue of "problem solving" was immediately evident: starting from their native digital backgrounds, the students identified the critical issues for the target users of their generation and tried to find technological solutions. The PBL perspective has identified nodal learning aspects as: 1) the ability to conceptualize issues related to the use of public space, 2) the ability to use ICT, 3) the development of communication capabilities of complex messages in messages understandable to the common citizen, 4) interpersonal skills with research groups, decision makers and groups of citizens' associations. To make the tool more accessible and easy to use, it has become necessary to implement the possibility of using text messages to send information from any type of mobile phone, not only from a smartphone. It was precisely during this complex phase that the student team tried its hand at the testing phase of the CrowdMap platform, through moments of verification and validation of the information received, and during the publication of the reports on the map.

4. ANALYSIS AND RESULTS: THE PBL PROBLEM SOLVING APPROACH

The research process adopted highlighted the following six levels of investigation in order to better recognize the context and specify the method for the next phase: we highlight those in which the perspective of PBL learning was more evident.

1. *Kick off.* A necessary phase of identification, contact and meeting with local actors and representative of the categories identified as "vulnerable".

2. *Definition of Criteria.* It is at this stage that the PBL approach seemed strategic to structure some student learning themes. In fact, the definition of criteria and categories for the

crowdfunding process has been a crucial phase in the problem solving approach proposed to students and subsequently to citizens' associations during the consultation phase. Thanks to the interaction with local actors through a series of "transect walking" (Figure 2), a reflection on criteria, categories, standard identification of the phenomena to be reported, has been set for a coherent achievement of a database, which allowed students to develop information translation skills in alphanumeric terms.

3. *Set up.* Starting from inputs acquisition from the local actors, the Ushahidi platform has been set up, then a website was designed to host all information and news. The comparison of students with IXem Labs, Department of Electronics and Telecommunications of the Polytechnic of Turin has initiated a phase of deepening knowledge and development of computer skills.

4. *Training.* With the support of the Fondazione della Comunità di Mirafiori Onlus, a group of 30 inhabitants was selected for collecting data on the area, and stimulating the 'crowd-mapping' effect. The students, the researchers, the PA with its technicians, the Fondazione Mirafiori non-profit organization and the associations - all together - have participated in some programmed "listening" moments.

Fig 2. The transect walks. Source: *https://areeweb.polito.it/mapmirafiorisud/wp-content/uploads/*

5. *On field data collection.* During June and July 2013 the group formed by the university students and the involved citizens made several data collections in the neighbourhood, sending information direct from mobile phones, app and computers to CMMS website, email and numbers. Once the information was received, it was checked for approval and then, if appropriate, was made visible on the map.

6. *On line.* Once the data collection was completed, outcomes were published, widely presented and made available to all the stakeholders involved and to the local administration. The mapping of the stakeholders through a hybridization of methods (Gephi model, Mendelow Method and CIA) represented an important moment of learning by the students with a PBL approach (Figure 3).

21 local sport agencies
18 Fondazione della Comu-
    nità di Miradiori Sud Onlus
    (local social agencies)
12 local health structures
11 local social agencies

⦿ network edges
8 local consultive bodies
6 Social structures
5 City of Turin
3 Universities
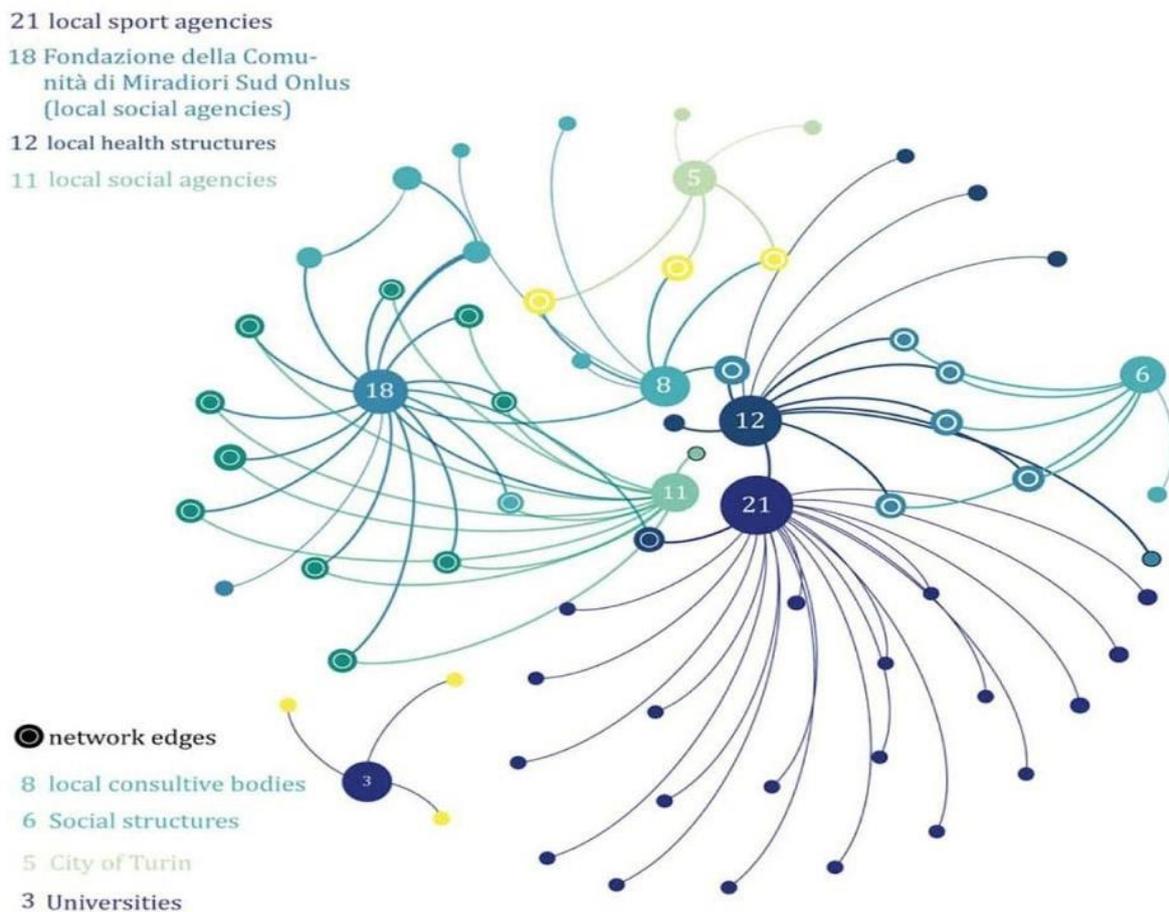
Fig 3. The stakeholders map: The Gephi Method. Source: *De Filippi et al., How..., 2017, p. 34*

7. *Monitoring and evaluation criteria of ex-post impact.* The criteria have been set up on the basis of the Community Impact Assessment/ Evaluation (CIA/CIE) methodology that evaluates in a descriptive manner the impacts - monetary and non-monetary - derived from the project in relation to the various actors involved.

5. CONCLUSIONS AND EXPECTED OUTCOMES

Several of the project's outcomes, in particular two according to the development perspective of the PBL approach: 1) the use of the platform by students and users is not limited to only identifying and reporting individual interventions (knowing the problems), but forces them to analyze phenomena on an urban scale: this has resulted in and will entail capacity for students to deal with complex problems; 2) the participation of local authorities, to build and strengthen their "accountability".

The central theme of the community engaged and of the service to the community to configure itself as a driving force for community empowerment did not appear as a hairpin or "immediately" by the community but it was substantiated with the storytelling by the students of the stories and the memory of the specific one community. Furthermore, if the service learning is problem based, it is oriented towards research and the solution of real problems connected to the life of the community to which it belongs, the role played by the students was that of consultants who have flexibly adapted their knowledge to requests, to the problems of the community in order to intercept possible solutions. The process is found to be non-linear, rather complex and complex necessarily mediated by the cultural, social and economic "stories" of the communities.

In the new MiraMap project, currently underway, which acquires and develops all the results achieved by the CMMS, we highlight training nodes indicated by the student team, with which they have ventured during the 6 months of workshops: 1) the restitution and visualization of the concentration or distribution of the data on certain areas, as well as the mapping of the different categories are not "cold" data, but has the intent to support the PA and citizens to think in terms of programming, for example of micro-interventions on some areas or maintenance activities of residual public spaces, 2) the strong demand for follow-up both by citizens and stakeholders; 3) the positive collaboration to define and categorize existent social and economic resources within the territory in order to better address shared needs and real resources analysis; 4) the participatory approach that accompanies and demonstrates each phase of implementation, testing and return of results.

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An Experience of PBL in the Learning of Urban Planning. Chair of Urbanism IIA, FAUD, UNC, Argentine Republic

Mónica Elisa Sánchez, Victoria Cebrián, Luciana Repiso, César Torres, Jorge Ruiz *

ABSTRACT

Within the framework of the CITYLAB LA "Engaging students with sustainable cities in Latin-America" Project, ERASMUS Program, this article reflects on the application of the Project-oriented Problem-Based Learning pedagogical method in the workshop work carried out by the Chair Urbanism IIA –Faculty of Architecture, Urbanism and Design, National University of Córdoba, Argentine Republic– in the first quarter of the school cycle 2017–, called "Urban-Territorial Plan for the Municipality of Villa Allende, Province of Córdoba. Scenario 2032". An evaluative analysis of the results of this experience is carried out in relation to the teaching-learning process proposed by the Chair.

The Chair Urbanism IIA belongs to the 5th year of the Architecture Degree and its main objective is that students develop professional competences for the study and intervention of the contemporary city as an integral fact inserted in various territorial and contextual scenarios, from the paradigm of environmental sustainability.

Keywords: Learning, Urban planning, PBL method

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SOME CONSIDERATIONS ON PEDAGOGICAL AND ORGANISATIONAL ASPECTS OF THE CHAIR URBANISM IIA

The Chair Urbanism IIA aims to contribute to the graduate of the Architecture Degree achieving the knowledge, skills, competencies, abilities and attitudes required to practise their profession as an Architect-Urbanist. Therefore, the expected results emerging from the teaching-learning process are as follow:
1. Develop the professional competences for the research and intervention of the contemporary city as an integral reality, inserted within diverse territorial and contextual scenarios.
2. Understand the problems and challenges of urban realities in their cross-scale and multidimensionality and of the urban-territorial transformation processes.
3. Understand and manage the contents, processes, methods, instruments and actors of urban-territorial planning and of local management oriented to physical-spatial-environmental planning.

For these objectives to be achieved, a set of theoretical-conceptual and methodological-instrumental contents are developed, which are organised into two thematic axes: (1) the study of the city in its municipal territory and in its regional context, through a multidimensional and cross-scale approach to urban-territorial studies; performing the analysis of the problems and challenges of the city of the 21st Century; proposing theoretical approaches on the paradigm of environmental sustainability and providing basic notions of demography, urban economy and urban infrastructure; (2) urban planning intervention through urban-territorial management, planning and projection, through the implementation of various methodological approaches that incorporate techniques and instruments of the prospective approach and of strategic thinking, such as the formulation of future scenarios, the key diagnosis Strengths, Opportunities, Weakness and Threats, the identification of opportunity areas for strategic projects and the study of the strategies of the various stakeholders involved in the process.

It should be noted that these contents are a novelty and a challenge for students in the 5th year of the career since in the previous years, the themes of analysis and project intervention are of small scale –a plot, a block or groups of blocks and a small urban fragment–.

The academic year takes place in 25 days and 100 class-hours. The Subject is dictated in two shifts: morning and night. The Chair is made up of a team of seven teachers: senior lecturer, adjunct professor, and five assistant professors.

Annually some 250/300 students attend Urbanism IIA –125/150 per shift–. Each assistant professor has workshops of 40/60 students that make up groups of 3/4 people. An important fact is that 60% of the students come from other cities and towns in the province of Córdoba and the country.

On the other hand, physical space is limited: theoretical lessons are taught in auditoriums with a maximum of 90 minutes per chair; the assigned workshops have a very tight capacity for practices in relation to the number of students, and with a time of 4 hours each.

Characterisation of the Workshop of the Chair Urbanism IIA

Two practical works are carried out for the simulation of the exercise of the professional role as Architect-Urbanist referred to the planning, projection and urban management of municipalities, with the incorporation of knowledge and transdisciplinary practices, for their performance both in the public sphere and in the function of independent professional advisor: (1) *Metropolitan Córdoba in future scenarios. Urban and project guidelines*, whose objective is to reflect on the complex territorial processes of global occurrence; (2) *Urban-Territorial Planning Plans for small/medium-scale municipalities of the Province of Córdoba*, oriented to urban planning intervention and to the exploration of different urban-territorial planning and management methodologies; adopting as cases municipalities in the metropolitan context of Córdoba –8,000 to 30,000 inhabitants–. The objectives of this work are the following:

- Perform a simulated practice of the elaboration process of an Urban-Territorial Planning Plan considering the insertion relations in diverse territorial and contextual scenarios.
- Develop methodological alternatives for the elaboration of an Urban-Territorial Planning Plan.
- Elaborate an urban-territorial diagnosis from a multidimensional approach.
- Perform urban-territorial planning proposals by means of structuring and configuration strategies, key projects and regulation guidelines.
- Essay the management of an integral urban project, recognising key actors and the required urbanistic instruments.

Special features of the Workshop of the Chair Urbanism IIA 2017 in the context of the CITYLAB LA Project

In 2017, the practical work called "Urban-Territorial Planning Plan for the Municipality of Villa Allende, Province of Córdoba, Scenario 2032" was developed, in which a practice of integration was carried out between the project-oriented PBL method –modality of the University of Aalborg (Askehave, Linnemann Prehn, Pedersen, & Thorsø Pedersen, 2016)– and the pedagogical strategy of the Urbanismo IIA Chair (Sánchez, 2015).

To the workshop objectives outlined above, those provided in the CITYLAB Project, Erasmus 2017 were added: work from the sustainable cities paradigm and achieve the continuous involvement of local agents in the analytical and propositive stages of the urban-territorial planning plan (Fernández Güell, Collado Lara, Guzmán Araña, & Fernández Añez, 2016) included in the development of practical work, and that it only implied deepening the application of indicators of the environmental sustainability paradigm, and establishing greater communication with the key actors: officials and inhabitants of the Municipality of Villa Allende and professionals of the provincial level of the Metropolitan Planning Institute

(IPLAM) within the framework of the guidelines proposed in the Master Plan of the Sierras Chicas.

VALUATION ANALYSIS OF THE RESULTS OF THE EXPERIENCE OF APPLYING THE PBL METHOD OF THE CITYLAB LA PROJECT IN THE 2017 WORKSHOP WORK OF THE CHAIR URBANISM IIA

The experience developed in 2017 allows the following evaluative analysis of the application of the PBL method in relation to the pedagogical-didactic proposal that is developed in the project workshop of the Chair Urbanism IIA.

Regarding teaching-learning strategies

The PBL method proposes to work with real-life problem situations from various perspectives and interpretations, such as learning engines (Nunez, Jonasen, Skov, & Ryberg, 2016). The Chair Urbanism IIA addresses the problems and challenges of the sustainable urban-territorial planning of various municipalities of the Province of Córdoba through the simulation of the development of an urban plan, with scales and challenges similar to those of the places of origin of the students. In this way, it is intended to provide them with the skills and abilities for their future professional work as an Architect-Urbanist.

PBL method assigns a key role to the teacher in the design of the problem (Restrepo Gómez, 2005). In this sense, the issue-problem is raised by the Chair, which carries out a profuse preliminary work linked to the search for information and preparation of documentation and cartographic material, and proposes an indicative methodological guide. All this material is shared through a Wix website of the Chair Urbanism IIA (https://urbanismo2a.wixsite.com/urbanismo2a). This is necessary because the work is carried out in 12 lessons (48 hours).

The PBL method considers that the student has the responsibility to learn, to identify knowledge gaps and to define a strategy to achieve that knowledge, and that the teacher must be a facilitator and a guide (Nunez et al., 2016). The Urbanism IIA workshop aims to achieve this involvement of students, and the assistant professor fulfills a guiding role, although some general guidelines are established based on the guides of practical work, because the massivity of each commission and the novelty of the work require it. Therefore, the teacher, from his role as facilitator of the teaching-learning process, activates the class through questions, suggests readings, case analysis or other resources to obtain information, answers specific questions, and uses different techniques to assess advance by teamwork, individual or of the entire group of students.

The Chair Urbanism IIA shares with the PBL method the premises that propose that knowledge is built and not transferred, that such construction requires individual, group and context

interaction, and to achieve critical thinking, reflection and communication; that work has to be as a team for collaborative and cooperative learning (Nunez et al., 2016). Each group of 3/5 students of the Urbanism IIA workshop must present their methodological proposal based on the activities of the general practice guide; seminars are held to reflect on the results achieved in the various stages of work with oral presentations based on presentations in power point.

The PBL method, in relation to the CityLab Project, raises the need to identify, select and assign external actors and manage the relationships between them and students (Harmer, 2014). These tasks must be carried out by the Chair, prior to the course development, because of the limited times of the work. On the other hand, the linkage with external actors is carried out in a few instances – since the municipalities with which we work are within a radius of 15 to 50 km from Córdoba Capital–. A key instance is a trip organized by the Chair to make a survey of the city and make contact with some officials of the Municipality and inhabitants of the town; another instance is conducting a talk-debate at the headquarters of the faculty with the participation of some officials in which they expose the problems of their municipalities and where students make various queries. To complete the linkage with actors, in the Plan Management Stage, in a class –4 hours–, the role playing technique is developed and each group of students assumes roles of the key actors for the recognition of their various perfonrance logics, the relations of force and influence between actors, the convergences and possible divergences regarding proposals- with the conceptual basis required for the argumentation of their positioning.

Regarding physical space, times and organisation
In a public university, massive and free, there is little availability of well-designed and equipped workspaces for different groups of students. There are only the workshops assigned for each teacher with commissions of 40/60 students, and at the assigned times.

Regarding the times of students, they are limited to the amount of subjects they attend per week, with their own requirements for partial evaluations and the carrying out of various practical works, simultaneously with the work in Urbanism IIA.

Therefore, in our context, the application of all the precepts provided by the PBL methodology cannot be carried out directly, but some aspects must be adapted to local conditions and/or limitations.

Regarding the valuation and assessment
One of the evaluation strategies of the PBL method refers to self and peer assessment, and another, to the importance of evaluating activities in the real world context (Nunez et al, 2016) and with the participation of external professional actors to simulate as far as possible a professional environment. In the Chair Urbanism IIA group presentations are mainly applied: in a seminar-workshop, all groups of students explain their work through the presentation of two panels in which they have synthesized the process of the development of the plan. In the

2017 experience, this was done without the participation of external professional actors, since their participation would have required their presence for 8 hours –4 per shift–.

Before the seminar-workshop, the peer evaluation methodology is applied that allows students to construct a critical discourse of their own work based on "seeing in the other".

IN CONCLUSION

Based on all of the above, it can be stated that the experience of applying –with the necessary adjustments set forth–, the PBL methodology has made it possible to reinforce and complement the pedagogical-didactic proposal of the Chair Urbanism IIA. In addition, this experience allowed us to test its organisational flexibility, which was able to be adjusted without major difficulties both to the objectives of the CITYLAB Project and to the tasks required for its achievement.

Collaborative learning is a necessity in the context of massiveness of the FAUD, UNC, so that in the Chair an environment is generated that encourages reflection, exploration, exposure, experimentation with ideas and methods, oral, written and visual communication. The student as the protagonist of learning, and peer collaboration is essential in this area of collective knowledge construction.

The approach of the same problem from different perspectives is another aspect of the PBL method proposal coinciding with the multidisciplinary approach proposed by the Chair Urbanism IIA to the issues it addresses, by incorporating basic concepts from other disciplines, the realization of multidisciplinary talks, with municipal and provincial officials and role-playing technique.

The issue of environmental sustainability is key in the diagnostics and proposals of urban-territorial planning in each municipality-case that is addressed, both from the approach held by the Chair throughout its history, and from the proposal of the Project CityLab.

On the other hand, there are two key issues that challenge the implementation of the PBL method from the pedagogical point of view in a public, massive and free university: that related to the roles and times that teachers and students must allocate according to the responsibilities and tasks proposed by the method, as well as the availability of the physical spaces and resources required.

Finally, in line with the Problem-Based Learning Method, the pedagogical-didactic proposal of the Chair Urbanism IIA is oriented so that the students are really the key actors in the construction of their knowledge to solve a certain situation, which allows them to develop skills,

abilities, competences and attitudes that they will require in their professional future as an Architect-Urbanist.

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Integrating Disciplines with PBL at the Autonomous University of Nuevo Leon (UANL)

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ABSTRACT

Problem-based learning is one of the most useful resources in education with the potential to effect real world change. The evident benefits of PBL in the face of the challenges that Latin America presently encounters have led many institutions to consider the adoption of PBL curricula. However, PBL implementation has its own set of difficulties. "I liked to work in a multidisciplinary team because our skills were complemented. Sometimes, it was difficult to understand our different ways of working, because we were focused on different things", said one of the students of our institution. This paper describes how different academic programs from the Autonomous University of Nuevo Leon (UANL) in Mexico, were integrated in a Learning Unit (LU) using the Problem Based Learning (PBL) methodology. First, we present some PBL definitions to delineate its main characteristics, like the students facing real problems. Afterwards, we describe the PBL implementation process at our university, its precedents, the administrative process, and the adaptation into an existing LU. Additionally, we describe how we adapted the PBL methodology to the Sustainable Ecological Environments course while also integrating the United Nations' (UN) Sustainable Development Goal (SDG) 11, dedicated to cities and sustainable communities. Finally, we mention some findings from the Sustainable Ecological Environments LU. Most notably, the students favour working in multidisciplinary teams and the amount of student investment was higher than in traditionally taught courses. Nevertheless, multidisciplinary work means a constructive challenge for teachers, because it involves a closer monitoring of the student's learning process and a different time distribution than traditional courses, with a higher time investment during planning stages.

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Keywords: Multidisciplinary approaches, Public Health, Industrial Design, Architecture, Sustainability

INTRODUCTION

Problem Based Learning (PBL) is an academic method where students acquire knowledge and develop skills for investigating and for responding to real problems (Barrows, 1986). The problem is the departure point, and in order to tackle the problem, organized groups of students develop academic projects. The projects are supported by courses where students obtain theoretical and methodological tools. The participation of a supervisor is necessary; nevertheless, the collaboration between the students groups, the supervisor, and external partners is significant. One of the core concepts of PBL is that students have the responsibility for their own learning (Askehave et al., 2015). Savery (2015) remarks that "PBL is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem".

This paper delineates the PBL implementation process at the Faculty of Architecture from the *Universidad Autónoma de Nuevo León* (UANL) in a multidisciplinary LU, starting with its precedents, until some findings from this experience. The precedents include the official contact of the UANL Campus Team with the PBL methodology at the CITYLAB Meetings in 2016, and the implementation of four pilot groups since the beginning of January 2017 until December 2017, as well as the results from that preliminary experience that contributed to design the final PBL course. Also in this section, the administrative process for creating an interfaculty PBL course is mentioned. Subsequently, the section "Adapting PBL to an existing LU" describes the procedure where two members of our campus team designed a final PBL course that consists in a multidisciplinary class based in an existing LU, integrating students from three undergraduate programs of the UANL.

In this course, students from undergraduate programs on Nutrition, Architecture and Industrial Design participated with Ph. D students, guided by five UANL teachers and two international Citylab consultants. These teachers were specialists in subjects like Bioclimatic Architecture and Urbanism, Public Space, and Social Sciences among others. The undergraduate students were divided in multidisciplinary teams from the three different programs; meanwhile the two Ph.D. students were teaching aides (TA), acting as advisors among the teams. The students decided to work on the urban context of the UANL Health Campus. They detected problems like lack of security, informal commerce and congested traffic, but they decided to work on the more visible problem of pollution and garbage.

Finally, we conclude with some findings from the final PBL course implementation, like the necessity to integrate more interfaculty elective projects along the university. The knowledge and skills acquired by our students while facing real problems was encouraging, and reinforces the plan of replicating the course. In order for replicability to be successful, we include some findings about both teacher's and student's expectations and challenges.

THE PBL IMPLEMENTATION PROCESS

To describe the PBL implementation progression at UANL, we mention some precedents and the administrative process for creating an interfaculty PBL course.

The precedents

Our first formal contact with PBL methodology was during the CITYLAB Inception Meeting, in Antwerp, Belgium in February, 2016, where the participant institutions decided to work on the 11th of the Sustainable Development Goals (SDGs) (UNDP, 2015). This particular goal strives to make cities and human settlements inclusive, safe, resilient and sustainable. After the Lima CITYLAB Workshop, in October 2016, we designed and implemented two workshops with teachers at the Faculty of Architecture from the UANL, with the intention of disseminating PBL into other courses and potentially growing our campus team.

Later, in January 2017 the first PBL implementation started on a pilot group at the Faculty of Architecture, inside the LU called *Urban Workshop I*, a 5th Semester course for architects (Facultad de Arquitectura UANL, 2018). This course had 16 sessions and it considered the participation of Campus Team members and stakeholders. Additionally, the PBL pilot group received the class in English. The subject for that course was the creation of a residential development in the municipality of General Escobedo, located at the north of the Monterrey Metropolitan Area (MMA). The implicated stakeholders were the authorities from the Urban Development Department of the mentioned municipality and Real Estate Developers that owned the site.

Because of administrative reasons regarding course openings and availability each semester, our PBL course wasn't fixed consistently to a LU. We adapted its content and methodology into available courses that fulfilled our criteria, namely, a course at the undergrad level, which could be enriched by having an urban problem as a starting point. It is also worth mentioning that Urban Workshop I and II projects are the same for the whole school, and project exhibition fairs are held at the end of the semester where comparison between different classes' solutions is possible.

Subsequently, during the Summer Course 2017, we implemented another PBL module with a second pilot group, in the LU named *Urban Workshop II*, a 6th Semester course for architects. This course also received the participation of Campus Team members and stakeholders. The subject for that course was the requalification of the Urban Core of Matamoros, Tamaulipas, a city located at Mexico-US border. The involved stakeholders were people from the Urban Development Office from the municipality of Matamoros.

Continuing with the process of adapting the PBL methodology, in the Fall Semester 2017, the third and fourth pilot groups were carried out for the LU Urban Workshop I and II. For the first of these courses the subject was the creation of a residential development nearby an ecological area in south of the MMA. The implicated stakeholders were Real Estate Developers. For the Urban Workshop II the subject the requalification of the UANL District. The project included the surrounding areas to the university campus, located in two municipalities from the MMA. The participating stakeholders were authorities from the municipalities of San Nicolas de los Garza and Monterrey, as well as people from the UANL.

In the four cited cases, we observed an enthusiastic involvement of the students until the midterm session, going together with a good presentation of their works. Nevertheless, the final presentation was not extraordinary. A space for student feedback was provided after each course implementation. In the last pilot group, feedback was through an online survey using Google forms. Among the results of this survey, the students expressed that the workload was higher in a PBL course than in a regular course, and that having a multidisciplinary team of teachers left them sometimes confused and contradicted about their feedback, mentoring and opinions. The majority of students, 78.6%, totally agreed that the PBL course encouraged collaborative work, as we can see in figure 1. A high percentage of students, 78.5%, agreed that the PBL course helped them better understand class concepts when compared to a traditional course, as seen in figure 2.

This course's PBL methodology encouraged collaborative work
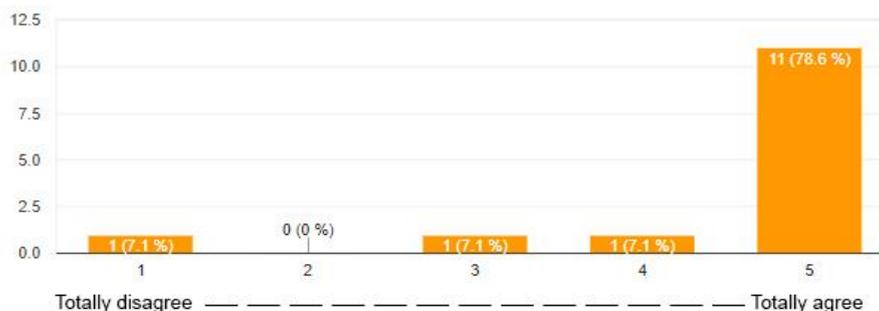
14 responses

Figure 1. Students answer to the question of whether the PBL course encouraged teamwork.1 is Totally disagree and 5 is Totally agree.

This course's PBL methodology helped me understand concepts better than in a traditional course
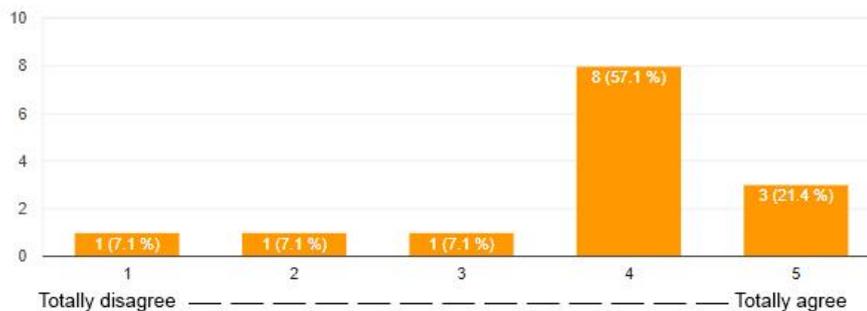
14 responses

Figure 2. Students answer to the question of whether the PBL course helped to better understand class concepts when compared to a traditional course. 1 is Totally disagree and 5 is Totally agree.

Based on the experience of the four pilot groups and the feedback of teachers and students that participated, the campus team members redesigned the PBL module. Also, the exchange of experiences that took place with the other universities in the CityLab meeting that took place in September 2017 in Buenos Aires, Argentina, contributed to the restructuring of the course. The integration of multidisciplinarity was done in varying degrees by all the participating members, according to their needs and possibilities. After hearing about the initial experiences of teams that took a greater multidisciplinary approach, the challenges of greater variety of disciplines in students, teachers and problem approach, seamed surmountable, and the benefits tangible. Consequently, the decision was reached that both student and teacher teams had to be multidisciplinary. We understood that the module in its prior form lacked flexibility to implement it adequately and we decided to create a new PBL course, considering multidisciplinary, multi-knowledge, and multilevel students issues and integrating an interfaculty team of teachers. We conducted some research on successful integration of disciplines in educational curricula, and concluded that in order to successfully manage multidisciplinarity in our course, all disciplines involved needed to be task oriented and focused on what their strengths where towards problem-solving (Salmon Cox et. al, 1977). At the same time, 15 teachers from the Faculty of Architecture and the Faculty of Public Health and Nutrition were in the process of completing the PBL Online training on the University of Antwerp platform, strengthening our original team. The experience of creating the new PBL course, its implementation and their final results after these changes were implemented are explained in the next section.

The administrative process for creating an interfaculty PBL course

The UANL (2011) Academic model considers the elective LU inside the curricula of each academic program. Their objective is promoting student's mobility and knowledge from outside their disciplinary courses. These courses can be taken in other educational programs of the UANL, or in other domestic or foreign institutions with which the UANL has established academic agreements.

In our case, the teachers Amanda Melissa Casillas Zapata and Karen Hinojosa Hinojosa designed a course based in an existing free election LU called *Sustainable Ecological Environments*, incorporating the 11th SDG principles and the UANL Campus Team members' knowledge. While contemplating the particulars of SD goal 11: inclusivity, safety, sustainability and resilience, and the problems of the Metropolitan Area of Monterrey, the concept of healthy cities emerged. A healthy city "is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential" (WHO, 1998). Monterrey poses several threats to health as a city because of its pollution problem (Fernandez Delgadillo, 2016). Thus we resolved to integrate into our multidisciplinary course the Faculty of Public Health and Nutrition from the UANL.

After an organizational procedure, the LU called *Sustainable Ecological Environments* was offered to undergraduate students from the Nutrition program, and from the two undergraduate programs of the Faculty of Architecture: Architecture and Industrial Design. The mentioned LU has four selected students from the Nutrition program, five from Industrial Design who decided to take the course, and three students from Architecture who only have this option for their inscription. In order to have a multilevel course, we invited two Ph.D. in Architecture and Urban Studies students, although administratively they are taking the course as extra credit, not as part of their programs.

ADAPTING PBL TO AN EXISTING LU

The design of the final PBL module "*Sustainable Ecological Environments*" LU is made by the principles of Competency-based education (UANL, 2018); this course tackles urban problems with a multidisciplinary systemic approach. The course integrates the objectives of SD goal 11: inclusivity, safety, sustainability and resilience, around the problems of the Metropolitan Area of Monterrey and the big idea of healthy cities. The course encourages the ability to work in inter, multi and transdisciplinary teams. The course was given by five teachers, specialists in subjects like Bioclimatic Architecture, Urbanism, Public Space, and Social Sciences among others. Each teacher had at least four in person classes with the students.

During the 8th week of the semester, we received the CITYLAB Experts Visit. Heilyn Camacho Nuñez, from Aalborg University (Denmark), and Sandra Ornés Vásquez, from Simon Bolívar University (Venezuela) made two workshops with the students, and some workshops and conferences with teachers and students from the previously mentioned UANL faculties. Also, among the activities carried out during their visit, they worked in a world café with the group, where they shared their PBL experience in the midterm of the semester.

The 12 undergraduate students were divided in four teams integrated by scholars from different programs; meanwhile, the two Ph.D. students acted as Teaching Aides and supported the research of all teams. The students focused on the surrounding area of the UANL Health Campus. A part of the group was already familiarized with the area and had real life experiences with the problems they were identifying. That aspect was a trigger that motivated their research and site analysis. We confirmed that initial interest in learning can be triggered by personal relevance (Hidi & Renninger, 2006), when we observed great involvement particularly from students coming from the Nutrition program, probably because their faculty is located at that Campus.

The students used different research tools to investigate the site problems, such as surveys, mappings, photographic records, videos, among others. They detected a diversity of problems like insecurity, traffic or informal commerce, but showed more interest in working on the problem of pollution, particularly solid waste in the area. The students decided to analyze the pollution problem not only from a local perspective but regional, that made them conscious of the problem dimension.

The problem definition was one of the main challenges for students within the PBL course. Pollution and garbage have a significant impact on other site problems that they were recognizing during each session, this issue was studied from the perception of the environmental education that has an interdisciplinary approach to promote a change of conscience towards the environment. In this sense, the ability to identify the problem and establish parameters in the approach of the solution allowed them to develop a critical skill, a fundamental aspect that according with Savery (2015) students could developed when they worked with this learning methodology.

In addition, the problem formulation and analysis phase took longer than expected during the course, because of that the students realized the importance of working on their time management skills. However, spending more time on the analysis due to the lack of knowledge about the problem allowed them to develop their research capacity and encouraged them to apply what they have learned on the evaluation of their hypotheses and possible solutions, these reflects what several authors has point out about self-direct learning like Hmelo-Silver (2004).

At the beginning of the PBL course the students were confused and struggled with the transition of working with more than one teacher, after few classes they adapted and embraced the experience of facing the teacher as a facilitator that would guide them rather than just teach them. On the other hand, for the teachers, the challenge was in the adaptation of a program that implicated a lot of internal coordination and organization for the five teachers that were participating on the process.

The evaluation is used to determine the effectiveness of the projects that were designed to improve the teaching and learning process (Savin-Baden & Major, 2004). One of the difficulties we encountered while evaluating the problem-based learning process was that the UANL uses traditional models of evaluation that are both quantitative and summative. Based on that, it was necessary to adapt an integral evaluation to a numeric value, requiring the involvement of the professors and experts during the evaluation process. In the same way, the students contributed to the evaluation, with feedbacks through an online poll, about the course and their PBL experience.

At the end of the semester, the students made a public presentation at the main hallway of the School of Architecture. They designed two posters and edited a video that described the development process of their project.

SOME FINDINGS FROM THE *SUSTAINABLE ECOLOGICAL ENVIRONMENTS* LU

The CITYLAB Experts visit lends us to see that students are favorable to work in multidisciplinary teams. Nevertheless, the experts perceive that it is necessary to integrate more interfaculty elective projects along the university. Multidisciplinarity means a constructive challenge for teachers, because it involves a closer monitoring of the student's learning process. Our team found that time investment distributions are different than in a traditional course, and that going into the experience with that expectation eases the transition into this way of teaching.

The experts remarked that our LU shows a process which includes theoretical aspects, the approach with communities and exchanges between both faculties. We consider, as a next step, to deepen the collaborative work and the solutions from the perspective of the SDGs.

Retaking the PBL principles, our students are acquiring knowledge and they are developing skills to problem-solve, researching and responding to real problems. Our student teams found the experience invigorating and exciting, but not without challenges. The feedback they received from five teachers and two experts sometimes was contradictory, and assuming and accepting that some contradictions were part of the multidisciplinary working model was one of the unexpected learning outcomes for both teachers and students.

IMPLEMENTING THE PROJECT AFTER THE COURSE

The final part of the LU, was announcing the winner team for participating at the Bogota students' competition. Three students from the Nutrition program, one from Architecture and other from Industrial Design were chosen. They decided to integrate the main ideas of the course and put them in practice to at least partially solve or mitigate the solid waste pollution problem they had defined. During June and July the students actively developed their project. For example, between the 11th and the 15th June they made a "schedule of actions", a self-criticism of the winning project, and a redefinition of the project integrating other SDGs.

The following week, students reinforced their theoretical framework and they made a list of stakeholders. They contacted UANL's *UNIVERDE Federation* and they learned about some sustainable existing actions at the institution. It is important to mention that the UANL is recognized as the most sustainable university in Mexico by the Federal Government and some international rankings like the UI GreenMetric World University Ranking on Sustainability (UANL, 2018). During the last week of June and the first of July, the students decided to produce an activation with Health Campus students that integrated the recycling process, waste management, ecological awareness, and recreational activities to make the experience memorable. They used *gamification strategy*, consisting in applying the concepts and mechanics of games, but "in an atmosphere of non-gaming" (BBC, 2013). The students decided to launch their project during the "Welcome activities for new students" at the Faculty of Public Health and Nutrition.

Since the majority of solid waste found at the site came from recyclable materials from food and drink containers, students collected aluminum cans and plastic bottles. They created with them two "intuitive pots" (Figure 3).

Figure 3. Intuitive pots designed by the students.

Between the 9th and the 13th July the group prepared its participation at the previously mentioned event. The students built a brand and they called the team *"Garra Ecológica"* (Ecological Claw), inspired by the university's sport teams nickname and mascot, Tigers. Also, the team made a *sustainable Kit* for the participants that includes Tupperware, eco-bags, reusable silverware and Thermos. On Friday 13th the recreational activities and the sustainability campaign started at the Faculty of Public Health and Nutrition.

This participation is only an example of the activities related to the project that the team continues to develop. At the moment of finishing this paper, our students have been invited to be part of some sustainable projects inside the UANL, like their participation in an internal forum at the Faculty of Mechanical and Electrical Engineering (Figure 4).

Figure 4. Publicity for an internal students forum in Sustainability at the UANL.

PBL courses don't have the responsibility or the objective of solving real world problems. Problems are greatly motivating excuses, fertile ground for knowledge and skills to grow from confronting them. However, when contextual learning is relevant to the students of PBL courses, there is great potential for projects to take a life of their own and transcend the limits of their intended goals.

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