Infrastructures: the Support of Urban Territories Approaches to producing a manual for teaching territorial infrastructures in higher education. Strategies for active lifelong learning.

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Abstract. Analysis of infrastructures in a city allows its competitiveness to be determined, and also identifies the degree of interest its citizens have in caring for the environment, the land, and existing natural resources. Including infrastructures in the study of urban problems makes appropriate planning and territorial management possible. Thereby guaranteeing a decent standard of living with a view to the future. Today the formation of students in higher education requires a new, collective, approach based on a set of teaching techniques that stimulate reasoning, discussion, the elaboration of projects to conduct applicable diagnoses, the testing of hypotheses worked out in the classroom, and conceptual proposals for solutions. The method of learning designed for the teaching of infrastructures is related to the nine most influential theories of UNESCO, from which those of Piaget and Vygotsky are selected with the idea of educating the student not only to be a passive receiver of information, but a participant interacting with users of the city, and the creator of new mental structures in a specific contemporary context; social experimentation, multiple intelligences and twenty-first century skills will give the students a perspective integrated with the rest of their education. The aim of this article is to show the process at work through innovative learning strategies that are applicable to the reality and the environment that we inhabit.

Key words: Teaching, Innovation, Infrastructures.

1 Introduction

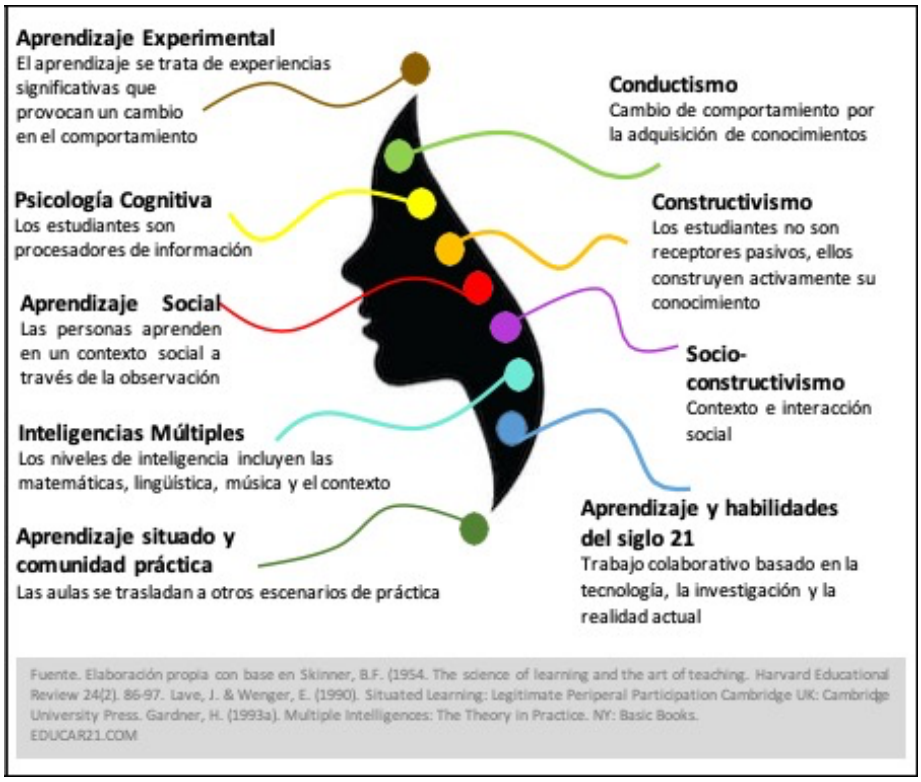
Higher education teaching should be geared towards developing an awareness of caring for the environment, water, land and the city. If first degree students get to know the different procedures for obtaining electricity, drinking water, and telecommunications, as well as how waste water and solid urban waste are treated, positive habits may be developed and as a result, there will be an improvement to the quality of life of future generations.

The first findings of this research study confirm that the techniques applied in the teaching of infrastructures, involve recognizing that the networks of public services are supports of the city, and an indispensable part of territorial management. It follows that identifying the function of the infrastructures, determining current problems with them, recognizing the role of the various actors in the city and analyzing the existing regulations, will give students critical, proactive and inclusive thinking on the subject to use in their lives.

2 Theoretical Framework

Being a specialist in topics concerning the city does not necessarily mean that one's knowledge can be taught in all its fullness. The teacher needs to have methodologies to transmit information to the students that they can appropriate without further thought. The course in Diagnosis of the Problems of Urban and Territorial Infrastructures has been built up on the basis of the nine most influential theories of learning of UNESCO. These theories complement each other in the creation of a process that combines experiences of acquiring, enriching or modifying knowledge, through skills, values, attitudes and visions. In this section, with the help of Figure 1, the theories and their use in teaching practice, are described.

Figure 1. The nine most influential theories of learning in UNESCO



Man learns through his senses and also from his experiences and practices. Theories of learning that aimed to improve the quality of teaching started to appear around 1900, and the first major current, developed by Thorndike and Skinner, was Behaviorism. This theory emphasizes analysis of newly acquired knowledge, because it is on the basis of this that changes in people's behavior are produced, as information becomes a tool for solving problems. The Cognitive Psychology started in 1950 by Frederick Bartlett and Jerome Brune, establishes that when students receive information from their teachers, they are able to process it and thus acquire new knowledge. Between 1970 and 1980, Constructivism, with Jean Piaget at the head, insists that students build up their knowledge from interacting with their surroundings, as the environment is a key element of learning and reorganizing mental structures. Then the idea of Social Constructivism (1990) proposed by Vygotsky, Rogoff and Lave, alongside the ideas already mentioned, recommended the interaction of students with society. Even though the learner is independent, he needs the teacher's

guidance to work on proposals to solve problems. This theory is characterized by collaborative work, where the individual is important because of the role he has in the collective.

In 1977 Albert Bandura devised the theory of Social Learning, which takes place in a space where people learn from each other on the basis of observation. Following a series of steps, the student develops his capacity for paying attention, so as not to miss a single detail of the practice. The theory of Experiential Learning puts the experience of the students at the center of the teaching process again. In 1984 Kolb sets out the idea that experience should be followed by reflection, which will allow the development of models and finally application of the knowledge. This theory makes use of the binomial terms trial and error, and cause and effect. Multiple Intelligences is another theory, developed in 1983 by Howard Gardner, which distinguishes three skills in the students' learning, that come from mathematics, linguistics, music, film and context. The three aptitudes are linked to problem solving, the creation of products and the search for new challenges, stimulating the students' abilities with the aim of educating them for life. Also the theory known as Situational Learning and the community of practice expounded on by Jeane Lave and Etienne Wenger highlight the act of commitment by students and teachers, that fosters social capital through team work and outside the classroom. One of the most important points in this theory is interaction with the community. Projects should not remain in the classroom; it is necessary to test them and reaffirm the findings obtained in the field.

Finally the theory of Twenty-first century Learning and Skills combines some of the earlier theories and adds others that represent the time in which we live. This proposition includes the various skills of a human being, in order to make his way of studying more effective. Also tools that are essential for the performance of specific actions in teaching. It encourages collaborative work and uses methods such as student centered learning and running projects. For technological skills it leans on the use of virtual platforms and specialized tools like programs and applications for team work. However, the basis of this theory is research, where the student connects to problems in the real world, and his learning skills are fortified through creativity, innovation and critical thinking.

3 Method and Results

The expected result is a guide for the teaching of urban infrastructures based on a program of Learning Units. The plan is to document the theoretical and practical experience accumulated through the planning of the course, the didactic strategies, evaluation, and some final reflections.

The methodology of the class begins with analysis of newspaper reports, which may be the element of reality that introduces the subject to be treated. Addressing subjects to do with the city requires up to date and accurate information on events at the local, national and international level. As this is learning for life.

The next activity is based on the theory of Cognitive Psychology. Presentation of the subject is a moment during the class when the teacher has the word. However the student is not only a passive receiver of knowledge, as he will have studied one or two readings on infrastructure before each class, so as to be able to take part in the teacher's exposition. Further, the teacher will have prepared examples, questions and specific situations, for the whole class to sift the knowledge and make it part of their lives. Having both parties involved like this enriches the explanation and encourages study in real situations.

To complement the presentation of the subject, individual or collective dynamics are introduced, activities that allow a prompt rational consideration of specific aspects of the readings and facilitate a relaxed environment for students to participate in. Experimental learning cannot be omitted. Visits to the field planned in advance allow the student to find out first hand how the infrastructures work, validating what was learned in the classroom. These practices complement what they were taught and motivate the students to learn by themselves.

Finally, the theories connected to twenty-first century skills and situational learning and the community of practice, are seen in the projects conducted throughout the semester. The aim of the first of these, called the Creative Project, is making an object with recycled materials. The second Project is one of Research, in which a diagnosis is prepared of urban infrastructures, to identify current problems. In this work, with the help of critical thinking and the use of information technologies, conceptual proposals are made for solutions, in order to design programs and/or public policies, with the application of newly

acquired knowledge.

4 Discussion

Infrastructure problems are linked to air and water pollution, the absence of land management planning and the subsequent underuse of facilities, deficiency in the provision of services and incomplete coverage, with the barriers created by infrastructures and the lack of citizen awareness. Inhabitants of the city have no idea of the processes that are needed for them to have electricity at home or in their work places at the press of a button, or, just by turning a tap, get water to bathe, do the laundry or water the garden. We are people who cannot be bothered to sort the garbage, as we are sure it will all be mixed up and dumped in a single place. We demand internet connections and safe streets without thinking about the joint effort of the authorities and private enterprise to design protocols and transport systems that will make the city work every day. What do we as citizens do to make the city work better? In the field of education it is our job to provide information and create a civic conscience so the process of caring for the environment and the land may begin, from our homes or our work places. These actions will allow knowledge to permeate society and turn into concrete positive actions that will transform the way the generations that follow ours think.

Following the same line of thought, discussion of teaching in higher education centers on the way a subject is taught. We are living in a time when virtual reality dominates in our lives and we have to take advantage of it in order for innovative ideas in favor of the environment and the people who live on this Earth to take material shape. So to recognize the tools that make the acquisition of knowledge more efficient, will help students to find their own way of learning, acknowledge their teachers' guidance, and be able to create real contexts, while being critical, aware and committed to the future.

5 Conclusions, limitations and future research

Classes on infrastructure are a fundamental part of the education of every student living in a city. Infrastructures represent the way cities work, providing the population with the services they need to have decent life, and generating competition for coverage and efficiency in the territory. In relation to the land and the environment, infrastructures are losing out, as man does not realize that the more

he transforms the land, the more problems he will have with the environment.

Sustainability is an attempt to think about society, the economy and the environment in a particular way that implies the infrastructure can only be sustainable with the use of building materials and techniques that are compatible with nature, as well as being more economical. Now is the time to act on behalf of future generations, and leave a world balanced between full space and empty space. Where people will be conscious of the implications of managing water, treating solid waste, the generation of electricity, the connectivity of individuals and mobility in the territory. And all of this can be accompished with education.

Teachers cannot stop introducing new elements to the planning of curricular activities and should bring themselves up to date with technological changes. Because losing the amazement of the students is like working with no direction. To be a specialist in the subject or to have all the work experience in the field, is not enough if the teacher has had no training. Therefore the teacher should have the pedagogic tools for transmitting his knowledge to the pupils. Knowing the theories will allow teachers to work with concrete objectives and try out techniques and dynamics suitable for his subject areas.

The limitations come with the generation gap between teachers and students. This problem can be reduced with the introduction of technological devices that the new generations of students are used to.

Future studies will have to establish the students' point of view with regard to the way class work is carried out and new knowledge is acquired.

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Figure 1.

Experiential Learning
Learning has to do with significant experiences that provoke a change of behavior

Behaviorism
Change of behavior through the acquisition of knowledge

Cognitive Psychology
The students are processors of information

Constructivism
The students are not passive receivers, they actively build their knowledge

Social Constructivism

Social context and interaction

Social Learning
People learn in a social context by observation

Multiple Intelligences
Levels of intelligence include mathematics, linguistics, music and the context

Situational Learning and Practical Community
Classrooms are moved to other places for practice

Learning and Twenty-first Century Skills
Collaborative work based on technology, research and current reality

Source: Author's own work based on Skinner, B.F. …..