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The Importance of the Theory and Practice Link in Pre-Professional Practices. Experience in the Civil Engineering Career

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***Abstract* - Pre-professional practices are learning activities that favor the integration of theory with practice, and are oriented to the application of knowledge and development of professional skills, being a methodological scientific support for the consolidation of the different knowledge of the study of Civil Engineering. The author considers that one of the difficulties that arises in the execution of the pre-professional practices is the disagreement between theory and practice, in addition to the fact that the interest of its implementation is more directed to compliance with the regulations, rather than to its use to strengthen the teaching-learning processes. This article aims to demonstrate the importance of the theory - practice link in the teaching-learning processes during the development of pre-professional practices. An experience of pre-professional practices was analyzed developing Project-Based Learning, in a rural community with the particularity of not having a pipeline drinking water supply service, in this project 42 students and two teachers of the subjects of Supply of Water and Environmental Engineering of the Civil Engineering career at UCSG in which they linked the theory with the practice necessary for the development of the project. With the present experience, it is concluded that the development of pre-professional practices improved the teaching-learning process, the students linked the theoretical contents of the classroom with the field activity and had a better understanding of the contents.**

Key Words:* *Practice, theory, pre-professional practices, project-based learning, learning, teaching.

1. INTRODUCTION

Higher Education Institutions (HEI) are currently focused on teaching processes, to achieve more efficient learning, where it is sought that the theoretical part, concepts and definitions can be inserted into a fairer and balanced duality with practical aspects, which come to represent in their essence the so-called pre-professional practices (PPP).

According to the RPC-SO-08-No. 111-2019, when referring to Pre-professional Practices in Title V, Chapter I, Article 53, mentions that they are learning activities aimed at the application of knowledge and / or the development of professional skills. And they have two components: Work Practices and Community Service.

Being Civil Engineering a science that from its theoretical bases can formulate projects aimed at providing a solution to the needs of society, it is understood that PPPs are the perfect training space for the integration of the theory - practice link, as a support methodological scientist for the consolidation of knowledge.

This work seeks to make an approach and analysis through an experience in which Project-Based Learning (PBL) is applied as a teaching model based on the use of real projects, based on a task or problem, related to the context of the profession (13), as a didactic methodology in which the importance of the theory - practice link and its application through PPP is analyzed; in a relationship between the teacher, students and society, to discover by learning about the practical components that lead to the discussion of results, and to the analysis of the necessary link between the conceptual and its applications.

The Civil Engineering career of the Catholic University of Santiago de Guayaquil (UCSG) carried out a training project in a rural community, from which the present experience is analyzed, this community has the peculiarity of not having a supply service of Drinking water through pipes, for which we worked with the Water Supply and Environmental Engineering subjects to be able to link the theoretical topics with the necessary practices for the development of the project.

A bibliographic review of the teaching processes with the project-based learning methodology was carried out, as well as concepts of theory and practice in general terms, as well as definitions of PPPs and how they are related to each other.

This article aims to demonstrate the importance of linking theory and practice in the teaching-learning processes due to the impact that it could have on the future professional work of students who are acquiring skills during the development of PPP, allowing them to obtain advantages in professional practice once they have completed their university studies.

This document, in addition to the terms mentioned in previous paragraphs, also addresses institutional guidelines for the continuous improvement of educational processes and the pedagogical skills of teachers to finally reach the integration of practice and theory in the framework of teaching-learning. of Civil Engineering.

2. DEVELOPING

2.1 The practical theory link in the teaching-learning process

Numerous studies coincide in pointing out that among the main causes of the low academic results of higher education institutions, the following are detailed: 1) Student desertion, 2) The high rate of repeaters, 3) The low passing grade averages and 4) Theoretical learning. All of this could be the consequence of the so-called loss of interest.

It would be convenient to analyze to what extent this teacher facilitator of knowledge has responsibility; Therefore, some factors that have to do with the aforementioned evils are analyzed: 1) The vast majority of teachers do not consider the importance of didactics, 2) The contempt for didactics encourages teachers to maintain traditional practices within the training spaces, 3) The main support continues to be the texts,

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with few field actions, 4) In the development of the classes, the theoretical is privileged over its application, 5) The evaluations still seek to discover memory capacities, above the live or apply the dictated content, 6) The teacher as a leader keeps a principle of authority that is not very permeable to student participation in the development of the expository class.
All this leads to a reflection of the current situation in education, focusing from the purely academic point of view, the teacher must develop skills that allow him in the training spaces to recognize which of his actions best accommodate the new conditions and the generation that he has to instruct. Based on the constructivist theory, it is a reconstruction between the teacher and the student, in two ways, in which the student learns and the teacher also learns to teach.
In this process of adaptability, the professional experience of the teacher plays a transcendental role, allowing him to articulate the theoretical contents of his subjects with activities of his profession and lead them towards practices. Despite the fact that theory and practice are two concepts that by definition are opposite, educational trends have linked them based on obtaining results in relation to a comprehensive knowledge and training of the student.
According to (4), theory is the knowledge system that explains the set of phenomena, facts or processes in some spheres of reality and that reproduces all the laws found in that domain under a unifying element.

(21), during the 9th International Congress of Higher Education, held in Havana-Cuba, points out the definition of practice as a continuous use, custom or style of something applied to education and is used when it is assumed with an instrumental nature that privileges action, demonstrates the need to put theoretical concepts into practice and thus consolidate the learner's knowledge.
Theoretical concepts and the reasoning of problems can be solved when their application in practice is presented. A good theoretical foundation about the subject can lead to an enriching practical experience of knowledge of the subject. (7).
In the field of education, theory and practice have to be linked; In this regard, (10), (17), (2), (12) and (22) highlight the importance between the production of knowledge and its implementation.
The theory and practice relationship is a complex process, which implies knowing, understanding and applying knowledge. Its success or failure is directly related to the social construction of meanings and the learning and development of social values, which have a high degree of individual responsibility, due to the characteristics of each learner. (14).
For the analysis of the teaching-learning process, we start from constructivism, as the pedagogical current that prevails in higher education since it considers that human learning is built, from the fact that people elaborate new knowledge with the base of previous learning.
The teaching-learning process is a series of procedures that the teacher must design to systematically advance the content of the class, through the construction of a personalized learning environment. The role change of the teacher, from transmitter to mediator, is imminent, being a guide to the student's self-regulated learning. What is taught is not considered in an exclusive and dominant way, but how it is learned. Therefore, the presence of the expository model is not lost, but it is minimized, in favor of the student's activity. (8).
Knowledge is built through experience. Experience leads to the creation of schematics. Schemas are mental models that are stored in our minds. These schemes are changing, enlarging and becoming more sophisticated through two complementary processes: assimilation and accommodation (J. Piaget, 1955. Cited by (9).
Learning can no longer be focused only on the acquisition of knowledge, it must also be oriented to the needs of the work environment and therefore the social environment, which is why the integration of field and laboratory work influences this theoretical knowledge.
The teacher has to integrate counseling and support actions for students, development and supervision of activities in different training scenarios inside and outside the classroom, preparation of didactic materials, the teacher can no longer give his chair without preparation, based on what you know, because some students would not be in the classroom, others would not understand, others would attend and see it as something that they have to pass with little personal interest and a group would attend with pleasure and interest. The teacher has to be prepared to reach the entire group of students.

Active methodologies are more conducive to teaching-learning processes, among these are case studies, problem solving, project-based learning, meaningful learning, collaborative and cooperative learning, among others.
For the interest of the article we focus on project-based learning, the constructivist pedagogical theory supports it, being an active methodology that takes the group as a fundamental unit of work to solve a problem of a real and multidisciplinary nature. (6).

2.2 Pre-professional practices in engineering careers

In the context of science teaching, (11) indicates that the basis of the practical learning model is “discovering for oneself, investigating the environment, understanding it”, especially in the case of scientific subjects where “no it tries to memorize the contents, equations, rules and formulas, but the slogan is to understand the problem, solve it and reason the answer”, as is the case of Civil Engineering.
Pre-professional practices are the perfect training space for the integration of the theory - practice link, this must be a methodological scientific support for the consolidation of knowledge. These PPPs with adequate planning, organization and control, hold the key so that students can transcend the approach of abstract theoretical knowledge that they receive through the different disciplines of the curriculum, towards the direct link with social reality and intervene in it contributing to its transformation, (18), being clear that with its improvement, education will improve.
Authors such as: (5) (19) (16) and (20) (2) agree that the PPP are a comprehensive training process oriented to the application of knowledge, the development of skills and the appropriation of values, it is a space for theoretical-practical reflection and analysis, in which they acquire experience on the role to be carried out to be carried out in the environment institutional, business or community.

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From the author's experience and the literature review, it can be stated that, in the field of education, one of the main problems is the disagreement between theory and practice (10), (17) and (3).
To achieve their objective, higher education institutions must direct their teaching-learning processes to the application of active methodologies, among them and very well used in civil engineering is project-based learning (PBL), with which integration is achieved. of the practical theory link through the development of pre-professional practices.

3 ANALYSIS OF THE EXPERIENCE

The present experience was analyzed in a project with the theme "Training for the rural community of San Andrés of the Nobol canton on the management and conservation of water for human consumption", carried out in September 2017, with the aim of improving living conditions of the community of San Andrés with approximately 300 inhabitants, which is supplied with water through tankers, which implies the storage of water in tanks outside the houses for all the uses that the family requires such as cleaning, food preparation and personal cleanliness.
42 students from the Water Supply and Environmental Engineering subjects of the UCSG Civil Engineering career participated in this project, the activities carried out were to take samples of the water, demonstrate to users through laboratory tests the quality of the water they consume and give training talks to improve the quality of life.

3.1 Methodology

The teachers in their classes presented the theoretical contents on drinking water quality, control parameters for drinking water according to Ecuadorian environmental legislation, sampling, laboratory analysis procedures, water disinfection methods and water contamination, of the program of study of the subjects of Water Supply and Environmental Engineering.
The teachers presented the project to the students, put together work groups and distributed the topics and activities to carry out the field work
The students prepared the training talks, made leaflets and posters with the assigned topics, this material was reviewed by the teachers.
Students in the community conducted training talks on different topics related to sanitary engineering and the environment, among the topics that were given were mentioned: water chlorination, cleaning and maintenance of tanks, contamination and proper water management.
The teachers in classes carried out the feedback of the project where the students presented their experiences.

3.2 Results

The objective of linking the theoretical contents of the syllabus of the Water Supply and Environmental Engineering subjects with the field activities necessary for the development of the project was achieved.
The experience was enriching, the students stated that the project had a positive impact on them, for example they said: “From their own experience it was possible to verify the usefulness of laboratory analyzes, despite the fact that the water was transparent, it had microorganisms that could cause diseases. ", Another comment" the ignorance of the community in relation to the handling of the water from the tank to the house and the contamination to which it is exposed "and" the appreciation of the community for the training and the needs regarding drinking water ".
From the feedback after the field activities, the following experiences of the students are mentioned:
• PPPs are of utmost importance in the Civil Engineering career
• The practices helped to understand the concepts given in class.
• The usefulness of the theoretical classes was evidenced.
• It was a more enjoyable learning process.
• The application of environmental regulations was evidenced.
• They have more skills for water laboratory processes and their usefulness and importance were evidenced.
• During the practical activities they recalled the theories received in class.
• This type of project should be carried out in all subjects.
• They felt useful by putting a grain of sand in improving the quality of life of the inhabitants of San Andrés.
• They think that the activities carried out are not going to be forgotten, unlike if they had to memorize them.

The teachers' comments were:
• Students' interest in doing field activities was observed
• Students are more motivated to study theory and carry out practicals.
• Students during PPPs have more freedom to ask the teacher.
• Students ask questions that they would not ask in class.
• During PPPs there are opportunities for group integration.
• More projects should be generated in which theory is linked to practice.

3.3 Analysis of results

It is observed by the comments of both students and teachers, that PPPs are important activities in the teaching-learning process in Civil Engineering. These practices carried out through project-based learning generate a more direct theory-practical link, with which students apply their previous knowledge, rebuild it and also develop specific engineering skills, with everything indicated they feel strengthened for adequate performance in your future profession.
This project-based learning methodology should be repeated at various levels of the curriculum, with specific projects focused on certain areas according to the level of studies until the end of the degree with an integrative project that covers several areas However, these engineering projects have to be prepared by the professors of the civil engineering career and reviewed by the area coordinators, considering the basis for the formulation of the projects the study programs of the different subjects, in order to link the theories with the necessary practices to consolidate the theories.
The projects should not be imposed by the faculty or departments external to the career, in which it is a matter of adjusting the practical activities to the project instead of the practical activities being adjusted to the study programs with which the project was developed.
In the analysis of results, limitations are also identified, for example the economic resources for carrying out the projects,

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the availability of full-time teachers and the availability of students' time outside of class hours, if they work.

4. CONCLUSIONS

With the analysis of the present experience, it is concluded that with the development of the project the teaching-learning process was improved, the students linked the theoretical contents of the classroom with the field activity.

Well-planned and structured pre-professional practices with the curriculum strengthen the theory-practice link and efficiency in the teaching-learning process

The application of active methodologies, such as the case of project-based learning (PBL), achieves the integration of the theory - practice link, generating that students build knowledge through the practices carried out, getting them to first link it to the theories given in class, assimilate it and then appropriate the knowledge through the development of pre-professional practices.

The experience was enriching for the students, showing at all times a positive attitude towards learning.

The teacher must promote learning with an environment that facilitates the participation of students, education is an interaction between the student and the teacher, it is not that the teacher gives the information without any feedback.

This knowledge shown in class, field or laboratory, should not remain as a storage of information that can be applied mechanically, but in an understanding of knowledge as a means to go deeper and be autonomous to act freely.

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