

Pedagogical Practice As A Learning Scenario For The Traditional Construction Of Rammed Earth Walls

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SUMMARY

Construction drives the economic development of a country, so it seeks to minimize the environmental impact by implementing sustainable construction practices, being traditional construction an effective, economical and environmentally friendly alternative. Higher education in its teaching process seeks to train professionals in construction with skills and capabilities, where actions, processes and methods respond to the existing and emerging needs of the industry and the population. The Universidad Francisco de Paula Santander, generates spaces of pedagogical practices so that civil engineers are trained in values and ancestral knowledge as construction with tapia, using the methodology of learning by doing through practical workshops, creating the necessary competences for the future professional. The pedagogical practice was carried out in Barichara - Santander possessing a wealth of materials, from its territory. With this practice, the appropriation of technical, regulatory and cultural knowledge of the area was achieved, with the transmission of the knowledge of experts in Barichara and the realization of construction processes based on earth such as the construction of walls in walls.

1. INTRODUCTION

The environmental, social and economic pressure on the construction industry is increasing day by day, due to the consumption of energy and natural resources, in addition to the generation of waste and pollution in its operations (Büyüközkan & Karabulut, 2018). Although construction drives the economic development of a country, it is carried out with unsustainable environmental practices (Ebolor et al., 2022; Ogunmakinde et al., 2022), due to this, it seeks to minimize the environmental impact by implementing sustainable construction practices, which has 3 main characteristics: social welfare, environmental protection and economic prosperity (Rajabi et al., 2022).

Sustainable construction is an industry approach to achieve sustainable development, seeking to minimize waste and improve resource efficiency along with environmental protection (Ogunmakinde et al, 2022. Traditional construction has been forgotten by industrialization, even though it is part of the culture of the regions, it does not generate waste or emissions on a large scale, making it an efficient, economical and environmentally friendly alternative. Because of this, the actions, processes and methods of building professionals must respond to the existing and emerging needs of the industry but with sustainable practices (Ogunmakinde et al, 2022).

Universities are the main agent of change that must provide answers to society's problems, one of the ways is by training the professionals who must lead it (Alba Hidalgo, 2017). That is why, higher education aims to empower students for decision making and responsible actions to ensure economic viability, environmental and social integrity (Taimur & Onuki, 2022). From the training of professionals, strategies are generated for the student to appropriate knowledge, develop skills and abilities that form him/her in values and knowledge, one of the ways is using the methodology of learning by doing through practical workshops, thus acquiring the necessary competencies for the future professional.

Civil engineers address issues related to works, construction projects, structural design, among others, which provide competencies to the future professional to perform in the construction sector (Bejarano Castellanos et al., 2019). The Universidad Francisco de Paula Santander, Ocaña, teaches future civil engineers the concepts, forms and applications of sustainable and traditional construction, through pedagogical practices as learning scenarios, in this way, students can take advantage of the knowledge and apply it in their natural environment with the available resources.

2. METHOD

A pedagogical practice was carried out with the students of Civil Engineering of the Universidad Francisco de Paula Santander, Ocaña, in Barichara - Santander because of its richness in materials, its development in earth construction and traditional techniques. In this practice the methodology of learning by doing was used, which is based on teaching from

experience, where the practical work gives the student the opportunity to apply the knowledge acquired in the theoretical classes of traditional construction to carry out the construction procedure complying with the technical and normative in the field.

The pedagogical practice was based on the teaching of Tapia construction, which consists of compacting the earth using a mold type formaleta. This type of traditional construction is an effective and economical alternative for builders, especially those located in rural areas or with difficult access to materials. The construction of walls is regulated by NSR10 (Colombian Construction Regulation) because both traditional and sustainable construction systems must comply with the established parameters.

2.1 LEARNING-BY-DOING METHODOLOGY

The learning-by-doing methodology comes from a constructivist current that aims at learning against classical teaching approaches (Rodriguez Garcia & Ramirez Lopez, 2014). The beginnings of this methodology arise with the work of the American philosopher and educator John Dewey (1859-1952), with learning based on a teaching program centered on the experience of the student body from a doing and a test (Garcia-Escudero & Bardí, 2019).

The structural elements of the learning-by-doing methodology are: action, method and theory, because learning takes place by interrelating action, theory and experience, making it an active learning experience for the student (Gamboa Mora & García Sandoval, 2012). To develop this methodology it is important to keep in mind some characteristics: that the student has an authentic experience, that he/she can use thinking spontaneously and share the experiences, knowledge acquired along with the results obtained in the activity (Mateus Ramirez, 2018).

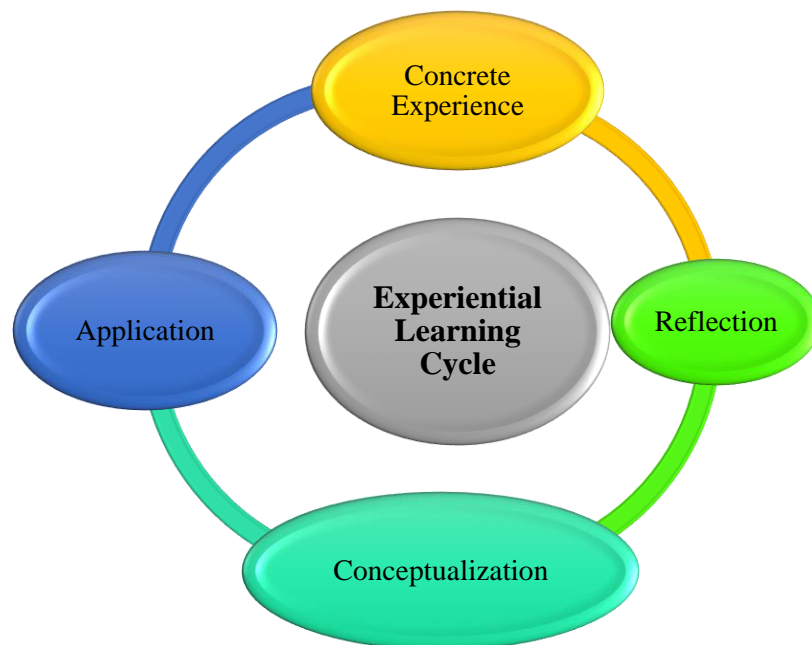


Figure 1. Methodology applied.

From the experimental approach is to ensure that the teaching of sustainable construction is effective and lasting. The academic practices seek mechanics that guarantee learning applied to the reality of the territory, where the main interest goes beyond the classroom, ensuring that the student connects the contents with their interests in a practical experience from the context, so that the pedagogical practices of the Universidad Francisco de Paula Santander seek to articulate the academic processes with the development projects and the different habitat scenarios, in this way, the professionals will have better competencies and skills to develop in the labor field. For this reason, pedagogical practices are used as experiential learning scenarios, with the application of the methodology that allows students to appropriate knowledge from experience and all their senses. as shown in figure 1

3. PROCEDURE FOR TAPIA CONSTRUCTION

The construction method of the rammed earth wall varies depending on local traditions. The soil used for this work is obtained from the area where the construction is to be carried out, since most of it is suitable for this construction method. The rammed earth wall consists of compacting the earth or traditionally said in treading or tamping layers of earth no larger than 10 cm to form solid walls, using for this work a formaleta with thicknesses and heights of 1 meter wide and high. as shown in figure 2



Figure 2. Wooden formwork.

Once the formwork is properly installed and leveled, which must have good characteristics of solidity and stability to correctly support the compaction without suffering displacements or decomposing its own structure, the builders will proceed to cover the needles with

previously selected stones which will prevent soil from coming out of the joints and will also allow the needles to be removed so that the wall can continue with the next one. The height of these stones varies between 8 to 15 cm in height to obtain a solid base that protects from humidity and rain. as shown in figure 3



Figure 3. Stone base for a wall.

Once a section of the wall is finished, these molds can be moved up or to the sides and then repeat the procedure to make the entire wall. as shown in figure 4



Figure 4. Tamped Tapia Wall

It is worth mentioning that the thickness of the walls made of stepped walls is easily recognized by their thickness, since they can range from 40 to 120 cm, this characteristic makes them very reliable at the moment of supporting compaction and tension stresses.



Figure 5. Tapia Wall

Once the wall is finished, the next step is to remove the formwork, a procedure that must be carried out carefully so as not to allow fractures or cracks that could compromise the stability of the wall. as shown in figure 5

4. CONCLUSION

In the learning process, pedagogical strategies and teaching methodologies are responsible for providing students with the necessary skills to perform in the labor field. Therefore, it is necessary the implementation of the learning-by-doing methodology in civil engineers so that from the experience the knowledge is appropriated, which goes from the theoretical to the practical.

Through the methodology, competencies were generated in the students, making them the protagonists of their learning process. According to the students' perception, this pedagogical practice allowed the appropriation of technical, normative and cultural knowledge of the area, with the transmission of knowledge from experts in Barichara and the realization of the procedure to build walls in walls.

The constructions in Tapia do not require specialized labor, however, they are the sum of efforts of workers who know the tradition of this construction technique; Tapia is getting

more and more attention from architects and engineers who are looking for the investigation of the technique and processes for its improvement and greater application.

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