Journal of Positive Psychology & Wellbeing
2023, Vol. 7, No. 1, 444-451

http://journalppw.com
ISSN 2587-0130

Practical And Theoretical Construction Skills For Medium Complexity Housing Projects

Haidee Yulady Jaramillo [1], July Andrea Gómez Camperos [2], Sir Alexci Suárez Castrillón [3]

[1] *Department of Civil Engineering, Faculty of Engineering, University Francisco de Paula Santander Sectional Ocaña, Research Group on New Technologies, Sustainability and Innovation (GINSTI), Ocaña, Norte de Santander*

[2] *Mechanical Engineering Department, Faculty of Engineering, University Francisco de Paula Santander Sectional Ocaña, Research Group on New Technologies, Sustainability and Innovation (GINSTI), Ocaña, Norte de Santander*

[3] *Department of Systems Engineering, Faculty of Engineering, Universidad Francisco de Paula Santander Seccional Ocaña, Grupo de Investigación en Ciencias y Tecnología (GRUCITE), Ocaña, Norte de Santander.*

Abstract

Quality education generates technical and professional competencies in students, with the implementation of pedagogical strategies, which have the purpose of facilitating their training and learning. In the academic training of civil engineering students at the Universidad Francisco de Paula Santander, strategies are generated for the student to appropriate knowledge and develop skills, through active learning based on the methodology of learning by doing, with the creation of construction models of medium complexity housing, bearing in mind the Colombian earthquake resistant construction regulations. The university's project fair is a scenario for the exhibition of the work of civil engineering students, where their participation is encouraged and practical and theoretical construction skills are sought. The construction systems and processes was one of the categories of the project fair, where the construction of medium complexity housing was evidenced, in which 20 civil engineering students of the sixth semester participated in the subject of construction 1. and evaluation of the teacher, the strengthening of their competencies is identified, mainly that of analyzing, projecting and designing civil engineering works, using the appropriate information for the solution of application problems, the ability to identify, plan and solve problems, among others, being a contribution to their professional development.

Key words: pedagogical strategies, practical competencies, participation, skills, education.

1. INTRODUCTION

Quality education is one of the sustainable development goals, which establishes that by 2030, the number of young people and adults with the necessary skills, particularly technical and professional skills, to access employment, decent work

and entrepreneurship should be increased (United Nations, 2018). Competency-based learning is an ideal educational approach, since it orients teaching processes towards different types of learning to address situations or problems (Martínez-Bustos et al., 2020), where the teacher implements pedagogical strategies in order to facilitate the training and learning of students (Gamboa et al., 2013).

Traditional teaching hinders the development of cognitive skills in the student such as analyzing and processing information, because it focuses on the transmission of information, with expository lectures and memorization (Márquez Cabellos, 2018). Due to this, teaching must ensure that all students acquire the theoretical and practical knowledge necessary to promote sustainable development, forcing to enhance the generation of critical knowledge and the formation of students who incorporate an ethical and holistic view in the exercise of their future profession (A. F. Pérez, 2018).

Active teaching methods allow the development of problem-based learning and the development of integrative projects (Castellanos González & Hernández Fereira, 2010). This learning method is action-oriented, so in an active learning environment students communicate, solve problems, simulate, use role changes, etc., motivating students to learn by doing (Carvajal Díaz & Ramírez Cajiao, 2008).

Civil engineers address issues related to works, construction projects, structural design, among others, which provide competencies to the future professional (Bejarano Castellanos et al., 2019), where the development of models brings students closer to the direct experience of reality in the construction sector (Sarmiento Ocampo, 2017). Models have been used as a method of three-dimensional representation, to show in a clear, understandable and interpretable way the constructive characteristics of a project, constituting for engineers and architects an indispensable tool to project their ideas (T. Pérez et al., 2017).

Higher education aims to empower students to make decisions ensuring economic viability and socio-environmental integrity (Taimur & Onuki, 2022). For this reason, in the academic training of civil engineering students, strategies are generated for the student to appropriate knowledge, develop skills and abilities through the creation of models, based on the methodology of learning by doing with active and constant learning.

Civil engineers must have technical skills and attitudes such as creativity, interdisciplinary work, teamwork and awareness of the importance of considering socio-cultural aspects in the performance of the profession (Garcia de León, 2007). The Universidad Francisco de Paula Santander, Ocaña, implements active learning in civil engineering students, generating practical and theoretical construction skills for medium complexity housing projects through the development of the project fair, which promotes collaborative work, knowledge and skills to search, process, analyze and represent territorial, industrial and infrastructure development projects, bearing in mind the Colombian earthquake resistant construction regulations (NSR-10, 2010).

2. PROJECT FAIR

The Universidad Francisco de Paula Santander, Ocaña in the Civil Engineering program trains professionals with the

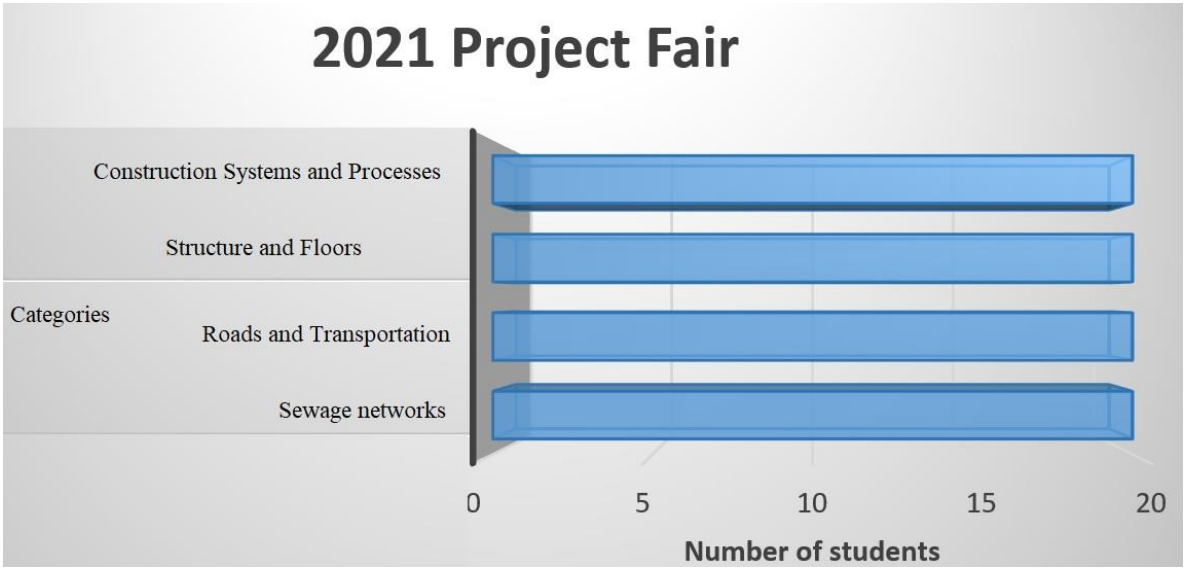
capacity to develop theoretical, technical and humanistic knowledge. The university in its formation has the purpose of developing both specific and generic competencies in students, implementing learning strategies as part of the academic development, for this reason, each semester the project fair is held, which allows students to present and participate with models of territorial development projects.

The project fair has been organized since the second semester of 2017 and invites the participation of students of the civil engineering program from all semesters (Figure 1). This fair contributes to the strengthening of competencies in students, such as: simulating civil engineering processes, applying knowledge, identifying, posing and solving problems, promoting innovation, development and creativity in future professionals.

Figure 1. construction processes in models

The project fair is a training strategy in the field of engineering and promotes learning, development of skills and abilities to face future challenges, contributing to the transfer of knowledge of the theoretical principles exposed in class, to the development of critical and reflective thinking (Velázquez López et al., 2022). This fair is a scenario for the exhibition of works by civil engineering students, where their participation is encouraged and practical and theoretical competencies in construction are sought.

The topics to be addressed in the 2021 project fair are construction processes, aqueduct systems, sewage systems, connections, structures and soils, among others. These topics correspond to the study plan of the civil engineering program, which is why students between the 1st and 9th semesters participate. Graph 1 shows the categories and number of students that participated in the fair in 2021.



Graph 1. Categories of the project fair and students of the Civil Engineering program.

3. CONSTRUCTION PROJECTS ACCORDING TO THE SEISMIC RESISTANT STANDARD OF 2010

In the year 2021, one of the categories of the fair was the construction systems and processes of housing projects of medium complexity, where 20 civil engineering students of the sixth semester participated in the subject of construction 1, where they generated practical, theoretical and technical competences. The projects in this category had to be based on the Colombian seismic resistant construction regulation (NSR-10, 2010), in title E "one and two story houses".

The projects had the technical specifications of the NSR-10 standard, where the foundations (beam, formwork, reinforced and cast column, spread footing), floor and slab (electrowelded mesh) and structural wall (lightweight thin brick, frouting mortar, mortar) can be found. Figures 2 - 4 show some examples of the projects presented at the project fair.

Figure 2. Construction process of a porticoed system.

Figure 3. Slab and foundation construction system.

Figure 4. Construction system of walls and foundations.

With the presentation of housing projects of medium complexity, an instrument was developed to measure the pedagogical strategy where the generic and specific competencies of the students are identified. Table 1 shows the competencies generated in the civil engineering students in their academic process.

Table 1. Competencies generated with the project fair

Generic Competencies	Specific Competencies
Appropriation of technical language.	Analyze, project and design civil engineering works.
Abilities to search, process and analyze information.	Apply knowledge of basic sciences and civil engineering sciences.
Ability to develop speeches.	Manage and lead human resources.
Ability to interact in new situations.	Propose solutions that contribute to sustainable development.
Knowledge of the area of study and the profession.	Manage and interpret field information.
Knowledge of new construction procedures	Use technological tools in civil engineering
Distribute tasks in group work.	Employ quality control techniques in civil engineering materials and services.
Manage resources, materials and equipment.	
Use appropriate information to troubleshoot application problems.	
Ability to identify, plan and solve problems	
Ability to design new ideas to solve everyday or disciplinary situations.	

4. CONCLUSION

The pedagogical strategies used in the learning process are responsible for promoting competencies in students, in order to facilitate their training and learning for the exercise of their future

profession. Therefore, the project fair is a strategy in civil engineering to prepare students in theoretical and practical knowledge, seeking the development of skills and abilities to face future challenges, promoting collaborative work, knowledge and skills to search, process, analyze and represent projects.

The project fair promotes active learning, based on learning by doing, focused on the student's capacity and responsibility, applying theoretical and technical knowledge. From the students' perception and the teacher's evaluation, the strengthening of their competencies is identified, mainly the ability to analyze, project and design civil engineering works, use the appropriate information for the solution of application problems, ability to identify, plan and solve problems, among others.

The students who participated in the category of construction systems and processes for housing projects of medium complexity strengthened generic and theoretical competencies, from oral communication with the speech for the explanation of their project to the appropriation of theoretical knowledge for their development as future civil engineers.

REFERENCES

1. Carvajal Díaz, A., & Ramírez Cajiao, C. (2008). Diseño de un modelo de evaluación para un ambiente de aprendizaje activo en ingeniería.
2. Castellanos González, L. M., & Hernández Fereira, A. (2010). Una alternativa metodológica innovadora para formar y evaluar competencias a través de proyectos de curso en las carreras de ingeniería. Revista de Educación En Ingeniería.
3. Gamboa, M. C., García, Y., & Beltrán, M. (2013). Estrategias pedagógicas y didácticas para el desarrollo de las inteligencias múltiples y el aprendizaje autónomo. Revista de Investigaciones UNAD, 12(1), 101–128. https://bit.ly/3CG3foN
4. Garcia de León, J. C. (2007). La formación del ingeniero civil. Congreso Nacional de Ingeniería Civil, August.
5. Márquez Cabellos, N. G. (2018). Las estrategias cognitivas y metacognitivas en estudiantes de sexto semestre de la licenciatura en educación especial. In Estrategias de enseñanza y aprendizaje para la docencia universitaria (Issue December 2018, pp. 2–21). Universidad de Colima. http://ww.ucol.mx/content/publicacionesenlinea/adjuntos/Estrategias-de-ensenianza-y-aprendizaje-para-la-docencia-universitaria_473.pdf
6. Martínez-Bustos, P., Niebles-Núñez, W. A., & Niebles-Núñez, L. D. (2020). Competencias matemáticas como factor de éxito en la prueba pro en universidades de Barranquilla, Colombia. Educación y Humanismo. https://doi.org/http://dx/10.17081/eduhum.22.38.3590
7. Naciones Unidas, C. (2018). La Agenda 2030 y los Objetivos de Desarrollo Sostenible: Una oportunidad para América Latina y el Caribe (Issue 10). https://doi.org/10.5354/0719-4633.2018.52077
8. NSR-10. (2010). Reglamento Colombiano de Construcción

sismo Resistente. 530–827.
9. Pérez, A. F. (2018). Educación para la sostenibilidad: Un nuevo reto para el actual modelo universitário. Research, Society and Development, 7(4), 174165.
10. Pérez, T., Ferreiro, I., Pigem, R., & Tomás, R. (2017). Las maquetas como material didáctico para la enseñanza y aprendizaje de la lectura e interpretación de planos en la ingeniería. Universidad de Alicante. Departamento de Expresión Gráfica y Cartografía., 8. https://rua.ua.es/dspace/bitstream/10045/21685/1/Comunicacion17052.pdf
11. Sarmiento Ocampo, J. A. (2017). Maquetas y prototipos como herramientas de aprendizaje en arquitectura. Arquitectura y Urbanismo, XXXVIII, 43–52.
12. Velázquez López, G., Vargas Almeida, A., García García, A., Domínguez García, A., & Cervantes Castro, C. M. (2022). Feria de proyectos como estrategia de fortalecimiento de las competencias de los estudiantes de los programas educativos de ingeniería para la solución de problemas de la sociedad. Estudio de caso de la carrera de ingeniería en automatización y control in. Revista Científica Multidisciplinar, 6(3).