

Service Learning as a Method for Teaching Numerical Analysis in Civil Engineering

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ABSTRACT

In contemporary civil engineering education, traditional teaching methods often fall short in engaging students or equipping them with the skills necessary to address complex, real-world challenges. This article explores service learning as a pedagogical method for teaching numerical analysis to undergraduate students at the Technical University of Civil Engineering Bucharest (UTCB). Service learning, which integrates academic instruction with community-based engagement, provides a dynamic and meaningful context through which civil engineering students can apply mathematical concepts to socially relevant problems.

The study centers on the application of the least squares method to construct a regression line, a fundamental topic in numerical analysis. Rather than introducing this concept through purely theoretical approaches, students participate in a field-based service project developed in collaboration with local urban planning authorities. The project investigates pedestrian movement near construction zones and its correlation with the distance from public transport stops. Students collect real-world data, apply regression analysis techniques, and interpret the results to assist in the design of safer pedestrian routes and mobility signage.

This case study demonstrates how mathematical modeling becomes more accessible and impactful when embedded within authentic civic contexts. By estimating a linear relationship between pedestrian traffic and transport accessibility, students create a regression model that directly supports urban infrastructure planning. The experience not only strengthens their technical skills in numerical analysis but also fosters essential transversal competences such as teamwork, critical thinking, and civic responsibility.

The outcomes suggest that service learning enhances student engagement, deepens conceptual understanding, and effectively bridges the gap between abstract mathematical instruction and the societal needs of civil engineering practice. The results support the broader implementation of service learning in STEM curricula, particularly in technical universities aiming to integrate academic rigor with sustainable development and community empowerment.

Keywords Service learning \cdot Numerical analysis \cdot Civil engineering education \cdot Regression line \cdot Least squares method \cdot Mathematical modeling \cdot Urban infrastructure

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