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SDG implementation in Civil Engineering curriculum. Case Study: Universidad Fidélitas

Alejandra Baldi[1] [0000-0002-0324-1550]
José P. Aguiar[2] [0000-0002-3922-5843].
[1,2]*Universidad Fidélitas, abaldi@ufidelitas.ac.cr*

Abstract

The SDGs have emerged with the intention of achieving sustainable development from the social, environmental and human perspectives. Education is a fundamental axis for the fulfillment of this goal, then, this research seeks to incorporate specific SDGs into the curricular framework of civil engineering career. To do this, a transversalization model was drawn up based on Deming's strategy, where the appropriate SDGs are identified for each course and then, mechanisms are established to evaluate the level of proficiency achieved by the students on the SDGs. The last stages of transversalization correspond to the analysis of the results and the establishment of improvement plans to design and apply strategies to continually ensure a better incorporation of the SDGs into the curriculum, as well as their assimilation by the students.

Keywords: SDG, accreditation, transversalization, sustainability.

Introduction

The Sustainable Development Goals (SDGs) cover a wide range of topics, from climate action to quality education. In the context of higher education, the SDGs provide a fundamental framework for integrating sustainability into curriculum, research and community engagement, which is essential for developing leaders that are committed to sustainable development, especially in STEAM careers such as civil engineering.

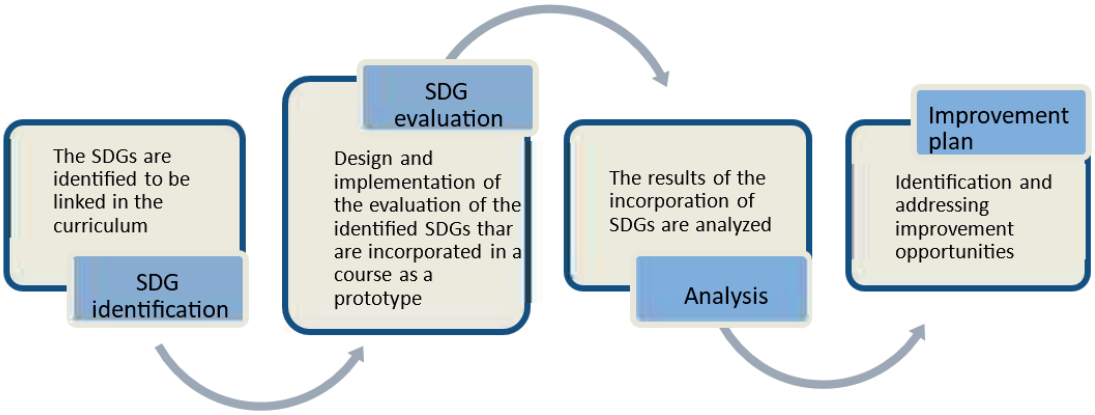
This career plays a crucial role in achieving the SDGs, since infrastructure projects directly impact on the social, economic and environmental well-being of communities. Civil engineers continuously apply sustainability principles in design, construction and management, thereby contributing to the achievement of multiple SDGs, such as clean and affordable energy, sustainable cities and communities, among others. As a result, is highlighted the importance of higher education institutions training comprehensive professionals with a sustainable vision in all areas, from the environmental to the social.

Therefore, the objective of this research is to incorporate the SDGs by means of a transversalization into the curricular framework of the civil engineering career.

Methodology

The incorporation of the SDGs into the curriculum involves 4 fundamental stages, based on Deming's strategy for continuous improvement (Agrawwal, 2021) (Figure 1).

Figure 1. Stages for the integration of the SDGs into the curricular framework of the civil engineering career



The first stage allowed the identification of 8 SDGs and to establish a corresponding link to the career courses (Figure 2).

Figure 2. SDGs identified that are appropriate to link to the career courses

Integration of the objectives of Sustainable Development in the curricular framework of the civil engineering career

The university applies a pedagogical model based on the constructivist paradigm. This model is consistent with the proposed curricular approach to incorporate the Sustainable Development Goals (SDGs) in the curricular plan of each of the courses, since it is based on the STEM philosophy that considers an active and collaborative methodology, characterized by being a constructive, contextualized, social and reflective process (Wahono, et al. 2020). In this model, the student is the center of the teaching-learning process, providing the possibility to trace the integration of SDGs by students throughout the training process.

The incorporation of the SDGs guarantees that students develop the skills demanded by the civil engineering industry at a locally, regionally and globally. Thus, it is ensured that the graduates of the program will perform successfully in any project in which they are involved during their professional practice.

Evaluation

To evaluate the incorporation of the identified SDGs, it was designed and implemented a methodology in congruence with the STEM philosophy applied by the career.

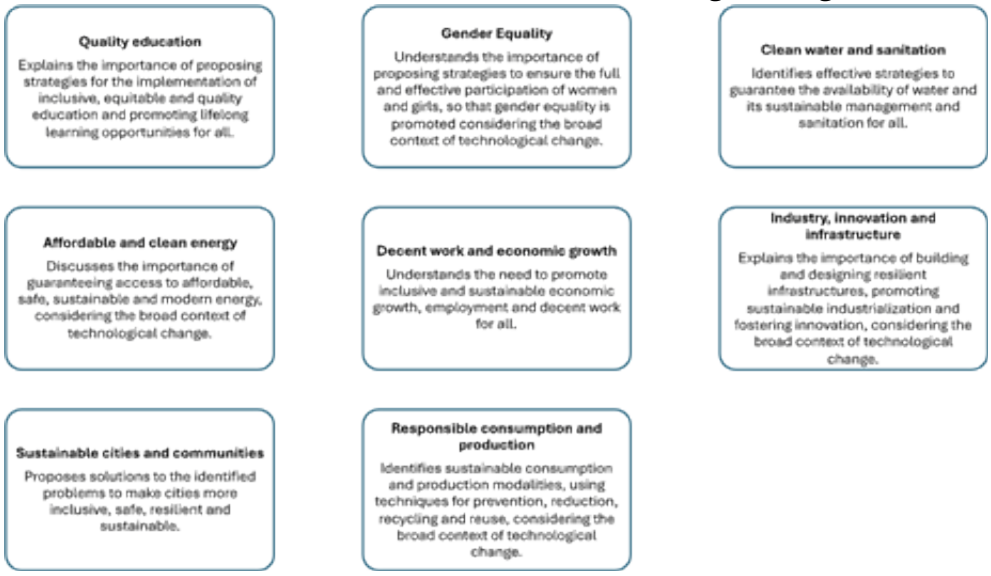
In accordance with Deming's strategy, in the "do" stage, an addendum is made to the programs of the courses in which the SDGs were identified to integrate. In the addendum the SDGs are specified and explained to facilitate their understanding for the teaching staff and students.

The assigned SDGs are worked on as a transversal axis of the course by incorporating them into an evaluative activity, for example, the final project, a case study, among others. Then, upon completing the corresponding activity is evidence of the participation of the students to comply with the SDGs.

Indicators

The indicators are established with the purpose of incorporating them into the rubrics of each course in which the SDGs are implemented (Figure 3). The proposed indicators seek to ensure that the evaluation of the implementation of the SDGs is developed in an objective and measurable way.

Figure 3. Indicators established for the evaluation of the incorporation of the SDGs in the courses of the curricular framework of civil engineering career



In turn, a level of compliance is assigned to each indicator using a score from 1 to 4.

Figure 4. Proficiency levels on SDG indicators and their associated score

Evaluation strategies

To evaluate the learning strategies where the SDG indicators are incorporated, a type of socio-formative evaluation is established, which focuses on developing and improving people's talent to face the challenges of society by addressing social problems, context and collaboration (Tobón, 2017).

Then, to evaluate the incorporation of the SDGs, socio-formative analytical rubrics are established as instruments, which serve to evaluate performance through levels and KPIs, considering a series of

indicators and the ability to address a contextual problem (Tobón, 2017; Guevara et al., 2020). These instruments have descriptors to determine the level of performance achieved by students more clearly (Tobón, 2017).

At this point, it is important to mention that, in addition to the teacher's evaluation, each student performs a self-evaluation of their performance in the assigned activity, as well as a co-evaluation where they evaluate the work of their groupmates. The same indicators described in Figure 3 are used in these assessments.

Results

Analysis

In this phase, the evaluation results for all courses are analyzed. To do this, teachers share the results obtained and feedback with the students, so that they can improve.

The final grade is obtained from the average of the self-, co-, and heteroevaluation. This will be evidence of the teaching-learning process of the course. It is important to mention that the minimum score to achieve the SDG is 3 and that 70% of the students must achieve a grade between 3 and 4 in the evaluation instrument (see Figure 4) for it to be considered that the SDG has been achieved and appropriately incorporated into the corresponding courses.

Consequently, the analysis involves estimating the overall average of the SDG grade achieved among all students that participate in the course, in addition to calculating the percentage of people who achieved the learning objectives and the incorporation of the SDGs.

Improvement plan

At this point, it is important to make an improvement plan for those courses that do not achieve the minimum grade required in the performance indicator. The improvement plan must be accompanied by a proposal of concrete actions to be developed in the near future.

The head of the school carries out a review of the results and feedback presented by the teachers to assess the points for improvement that are proposed by them. The improvements to be applied are made in all courses that did not reach the minimum of 70%, in a standardized way for all groups.

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