THE EDINSOST2-SDG PROJECT: INTRODUCING SDGs IN HIGHER EDUCATION

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Conference Key Areas: *Sustainability. Sustainable Development Goals; Curriculum Development, Engineering Skills, Lifelong Learning.*

Keywords: *Sustainability competences; Competency map; Sustainability Education; EDINSOST project; SDGs Higher Education.*

ABSTRACT

The main objective of the EDINSOST2-SDG project is to introduce sustainability and the Sustainable Development Goals (SDGs) in Higher Education. The project focuses on Engineering degrees, Education Degrees, and the Business Administration and Management degrees of the Spanish university system. The project has four main objectives: (O1) Identify the SDGs in the EDINSOST sustainability competency maps

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doi:10.5821/conference-9788412322262.1217

(SCM); (O2) Improve the learning outcomes of sustainability and SDGs in the degrees related to the project; (O3) Faculty training in Education for Sustainability and SDGs; and (O4) Analyse the students' learning in Sustainability and SDGs during their training at the university. The current project began in 2019 and is scheduled to end in December 2022. This paper presents the main results achieved so far in the O1. SDGs have been included in the SCMs previously designed by the EDINSOST project. Each SCM learning outcome is related to a set of UNESCO learning objectives and UN indicators of the SDGs. As EDINSOST2-SDG results, the SCM has been simplified to make it easier for teachers. A pilot project is currently being carried out at the UPC-BarcelonaTech to analyse ten engineering degrees using this simplified SCM. The results of the pilot project will be presented in June 2022, but the preliminary results show that the reduction in the number of learning outcomes has been a key aspect to motivate those responsible for the different degrees involved in the pilot project to use the SCM as a tool to introduce sustainability in their degrees.

1 INTRODUCTION

The university has an important role to play in an eco-social transition that is essential to overcome the major challenges our society faces as part of nature [1]. As an institution dedicated to the creation and transmission of knowledge, the university may lead the way towards a culture of sustainability, through research and teaching [2] and from the experience and learning of the university community itself. To this end, the integration of Education for Sustainable Development (ESD) in Higher Education (HE) contributes to the development of sustainability-related competencies of students and university staff. Competencies such as critical and creative thinking, systems thinking, collaboration, action and problem-solving skills contribute to the training of potential eco-social change agents.

The United Nations 2030 Agenda identifies the need to integrate the Sustainable Development Goals (SDGs) into university curricula [2] as a service to society. This integration represents an opportunity for interdisciplinary and transdisciplinary collaboration in education, research, and innovation, oriented towards the 17 SDGs. The new global framework "Education for Sustainable Development: Towards achieving the SDGs" or "SDGs by 2030", adopted at the 40th session of the UNESCO General Conference [1], encourages the introduction of the SDGs in HE.

The increasing commitment to EDS of more than a thousand HE institutions is reflected in more than thirty international declarations and initiatives [3]. Yet the syllabus of the world's universities is still far from achieving a sustainability orientation. Sustainability is often present in isolated experiences and initiatives that do not reach the learning of all students [4]. Universities should strive to expand and improve teaching-learning actions beyond the usual teaching practices [5], since it is in this area where the greatest difficulties arise for both teachers and students [6]. On the other hand, some studies (in this case focused on the field of engineering) show a lack of social commitment as students' progress in their studies [7], [8], indicating that the challenge is even greater in engineering [9]. It is therefore essential to move towards curricular sustainability in the University System, allowing critical reflection, fostering interdisciplinary collaboration, and learning the necessary skills so that the university community can catalyse change towards a more sustainable society.

Different research groups have worked from many points of view and at many levels on the competencies needed to meet the challenges of sustainability and the SDGs. These works have led to the UNESCO Education Guide for Sustainable Development Goals: Learning Objectives [10], which presents eight key competencies for sustainability: Systems thinking, Anticipatory, Normative, Strategic, Collaboration, Critical thinking, Self- awareness competence, and Integrated problem solving. The Guide proposes 15 learning objectives for each of the 17 SDGs, classified according to a three-level taxonomy: Cognitive, socio-emotional and behavioural.

The Executive Committee of the Conference of Rectors of Spanish Universities (CRUE) defines in its "Guidelines for the Introduction of Sustainability in Curricula" four

sustainability competences considered essential in the curricula of higher education degrees [11]:

- C1: Critical contextualization of knowledge by establishing interrelations with social, economic, environmental, local and/or global problems.
- C2: Sustainable use of resources and prevention of negative impacts on the natural and social environment.
- C3: Participation in community processes that promote sustainability.
- C4: Application of ethical principles related to the values of sustainability in personal and professional behaviour.

Different perspectives are aligned with the mentioned UNESCO and CRUE competencies for sustainability [9] in engineering. The Barcelona Declaration [12] of the International Conference on Engineering Education for Sustainable Development proposes the competencies that engineers should acquire in order to face the sustainability challenges. The accreditation agencies for engineering degrees (ABET, ENAEE, Canadian Engineering Acreditation Board) also recognise the need to incorporate these competencies and propose a series of learning objectives.

The EDINSOST projects, financed by the Spanish State Program for R&D&i, arise from the need to promote ESD in Spanish universities. In two consecutive projects, EDINSOST and EDINSOST2-SDG, more than sixty researchers have carried out a highly multidisciplinary work between twelve universities in three fields of knowledge: Engineering, Education, and Business Administration and Management. The research has been contextualised and applied in all the participating universities. Both projects are carried out with the aim of integrating sustainability into the curricula of the participating universities by designing innovative teaching-learning actions, evaluating the knowledge of the teaching staff in sustainability and designing a training strategy for them, and discovering the competency level in Sustainability of current graduates in the Spanish university system.

Based on the sustainability competencies defined by CRUE [11], the EDINSOST project [13] developed Sustainability Competencies Maps (SCM) for the three areas of the project [14] and evaluated pedagogical strategies and appropriate evaluation instruments to develop the sustainability competency. Three years later, the need to incorporate Education for the SDGs in the same three areas resulted in the approach of the EDINSOST2-SDG project. The project developed two other tools for the introduction of sustainability in the university system. The first, the "Map of sustainability presence" of a degree, shows the percentage of presence of sustainability competencies in the curricula. The second one consists of a questionnaire that, for each competency, asks about the level of ESD that students perceive they have acquired. The comparison of the result of both tools allows us to glimpse the effectiveness of the incorporation of ESD and the SDGs to a degree.

However, this effectiveness should be validated through direct assessment of student learning. At the same time, the project is working on the development of a database of open educational resources (OER) related to the SCM, on the design of a teacher training course, and on tools that allow the introduction of ESD in final degree projects.

The incorporation of ESD and the SDGs in university degrees is not trivial. Strategies must be modified to integrate courses, activities, and content in the different degrees in a systematic, interconnected, and coherent way [5]. Several of the participating universities in EDINSOST2-SDG are implementing initiatives to achieve this integration. In 2021, the Universitat Politècnica de Catalunya (UPC-BarcelonaTech) started a pilot project in ten degrees to introduce sustainability in their curricula using the EDINSOST2-SDG methodology. The pilot project represents an opportunity for sustainability competencies to be normalised as part of university engineering education [15]. Management teams and teaching staff have been involved in the implementation of the EDINSOST2-SDG tools in each degree: SCM, Map of sustainability presence, teacher training courses and OER database. During this process, a problem inherent to the SCM presented in [9] has arised: in degrees where there are no sustainability experts, teachers have been reluctant to use the SCM due to the large number of learning outcomes it contains (53). To solve this problem, the EDINSOST2-SDG team has simplified the SCM to make it easier to understand and use. This paper presents the work developed to achieve this goal.

2 METHODOLOGY

The Engineering SCM of objective 1 of the EDINSOST project was presented in [14]. The SCM is structured based on the four CRUE sustainability competencies, which are subdivided into seven competency units (CU). Each of these seven CUs is defined using the Simplified Miller Pyramid [16] as the taxonomy of learning. This is a taxonomy of three domain levels: know, know how, and demonstrate + do. For each domain level of each CU, the set of learning outcomes related to sustainability that an engineering graduate must acquire on completion of their studies are defined.

The EDINSOST project had considered multiple sources of information to create the SCM, but the SDGs were not among these sources because their publication coincided in time with the work done during the project. For this reason, in the EDINSOST2-SDG project it was decided to update the SCM to take into account the SDGs. The result, together with the validation process of the new map, can be found in [9]. In total, the new SCM has seven CUs and defines 53 learning outcomes. This is a very high number, which makes it difficult to implement the SCM in an engineering degree. For this reason, a process of simplification of the SCM was carried out, so that the number of learning outcomes was significantly reduced. This allowed obtaining a SCM of only 28 learning outcomes. Having a reduced number of learning outcomes not only simplifies their introduction in the curricula, but also makes it possible to reduce the number of questions in the surveys to build maps of the presence of sustainability in a degree (objective 2) and to analyse the perception of students about

their own learning (objective 4). It also allows having to develop a database with less number of OER (objective 3).

The way to reduce the number of learning outcomes has been to combine several learning outcomes into a single one whenever possible. For this, two considerations have been taken into account. The learning outcomes to join:

- must belong to the same CU and to the same domain level
- must deal with similar aspects, so that the result of their union is natural

For example, the following learning outcomes:

- Include indicators in their projects for measuring social impact (e.g., Social Life Cycle Analysis, ISO 26000, Directive 2014/95 / EU for non-financial reporting).
- Take into account in their projects and actions safety, health and social justice criteria (e.g. ergonomics, accessibility, user experience, equity, diversity, common good, transparency, human rights, gender perspective, needs of the most vulnerable groups, discrimination, dignity, fight against corruption).

have been joined in a single learning outcome in the simplified MCS:

- Takes safety, health, and social justice criteria into account in their projects and actions and includes indicators to measure social impact.

As it can be seen, the process has also served to simplify the writing of the learning outcomes, which makes them clearer for teachers.

To relate the learning outcomes with the SDGs, the relationship matrices of the learning outcomes with the learning objectives of the SDGs defined by [10] and with the goals of the SDGs [2] have been used. These matrices had been initially developed for the MCS presented in [9] so it has been necessary to simplify them. To do this, each learning outcome of the simplified SCM has been related to the learning objectives of UNESCO [10] and to the goals of the SDGs with which all the original learning outcomes were related (from the MCS of 53 learning outcomes).

3 RESULTS

Table 1 shows the simplified MCS structure and an example for the Competency C4: Application of ethical principles related to the values of sustainability in personal and professional behaviour, with its three Learning Outcomes at different learning levels.

Table 1. Example of the simplified MCS for Competence C4.

Competency	C4. Application of ethical principles related to the values of sustainability in personal and professional behaviour.

Dimension	Holistic
Competency Unit	CU4.HO. Acts according the ethical and deontological principles related to the values of sustainability
Level 1- know	C4.HO.1.x. Knows their professional deontological code, the main ethical dilemmas and the laws and regulations related to sustainability. C4.HO.1.y. Knows the concepts of social commitment and corporate social responsibility, its possibilities and limitations.
Level 2- know how	C4.HO.2.x. Is able to identify and critically evaluate the implications of the ethical and deontological principles related to the sustainability values in their professional domain and to critically evaluate the social responsibility of companies' activities.
Level 3- demonstrate and do	C4.HO.3.x. Is capable of exercising their profession, and of actively participating in responsible action in the entities in which he/she develops their profession, taking into account ethical principles related to the values of sustainability (e.g. equality, justice, precautionary principle, prevention of damage, responsibility towards present and future generations, protection and restoration of a healthy environment, social, economic and environmental human rights).

The analysis for all 28 Learning Outcomes of the simplified SCM with the SDGs Learning Objectives and SDG indicators shows that they cover all SDGs but SDG2- Reduce Poverty. The more represented SDGs in the SCM are: SDG4 - *Quality Education,* SDG9 - *Industry, Innovation and Infrastructure* and SDG 12- *Responsible Consumption and Production*, which make sense for engineering education. Table 2 shows, as an example, the relation between the Learning Outcomes for C4 and the SDG.

Table 2. Example of the relation between learning outcomes of the SCM and SDG for Competence C4.

	C4.HO.1.x.	C4.HO.1.y.	C4.HO.2.x.	C4.HO.3.x.
SDG1			X	X
SDG2				

SDG3	X		X	X
SDG4	X	X	X	X
SDG5	X	X	X	X
SDG6	X		X	X
SDG7				
SDG8				
SDG9	X		X	X
SDG10	X	X	X	X
SDG11				X
SDG12	X		X	X
SDG13			X	
SDG14				
SDG15	X			X
SDG16		X	X	X
SDG17			X	X

The simplified SCM is currently being piloted in 10 degrees at UPC-BarcelonaTech in order to effectively introduce sustainability learning in all University degrees.

3.1 Summary and ACKNOWLEDGMENTS

In this paper some results of objective 1 of the EDINSOST2-SDG project have been presented. The reduced Engineering Sustainability Competencies Map (SCM), which contains 28 learning outcomes that all engineering students should have acquired on completion of their studies, allows curriculum designers to introduce sustainability and the SDGs, and makes it easier for teachers the design of related activities. The learning outcomes of the SCM include the UNESCO learning objectives and the goals of the SDGs related to engineering. We want to thank the work of all the members of the EDINSOST2-SDG project, and in particular the components of the engineering working group. All of them have made this work possible.

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