GREENVERSITY CORE: THE FRAMEWORK OF COMPETENCES AND EVALUATION CRITERIA TO IMPLEMENT A SUSTAINABILITY-DRIVEN MINDSET IN HIGHER EDUCATION

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Abstract

Embedding sustainability across higher education is crucial for preparing future professionals to address the environmental, social, and economic challenges of the twenty-first century. Universities play a key role as catalysts for a sustainable and resilient society. By integrating sustainability competencies into curricula, they can foster systemic thinking, innovation, ethical leadership, and collaboration.

The European Commission's Joint Research Centre (JRC) developed GreenComp, the European Sustainability Competence Framework[1], as a unified model to guide learning in environmental sustainability across all educational levels. Building on this, the GREENVERSITY project adapted GreenComp to higher education through the Greenversity CORE Framework of Sustainability Competences [2]. It articulates each competence domain in terms of distinct components of knowledge, skills, and attitudes (KSAs), structured within a taxonomy that strengthens conceptual precision and practical applicability.

This is an example of "Valuing sustainability" competence:

- General definition: to reflect on personal values; identify and explain how values vary among people and over time, while critically evaluating how they align with sustainability values.
- Knowledge objective: to understand that sustainability is shaped by diverse and sometimes conflicting value systems, and can describe how worldviews (such as anthropocentric, technocentric, and ecocentric), cultural, generational, and socioeconomic factors influence sustainability perceptions and decisions, while recognizing that inclusive engagement across all value systems is essential.
- Skills objective: to demonstrate the ability to critically assess, compare, and deliberate on different sustainability values and principles, integrating these into personal and collective decisions and actions while recognizing environmental impacts and diverse perspectives, and the importance of cooperating across differing worldviews rather than relying solely on one's own values.
- Attitude's objective: to demonstrate openness to reflect on personal values critically, respect diverse cultural perspectives, and adopt a reflective, inclusive attitude grounded in sustainability principles.

To foster effective implementation, a three-level rubric has been designed for each KSA category (level 0–red, level 1–yellow, and level 2–green), guiding educators in the progressive evaluation of competence development and ensuring alignment with course learning outcomes.

In conclusion, the GREENVERSITY CORE Framework provides significant benefits for its various target groups. For educators, it provides explicit methodological guidance and practical tools (such as KSA descriptors and rubrics) to integrate and assess sustainability competencies systematically across disciplines. For students, it enables a more comprehensive and transformative learning process that cultivates systems thinking, critical reflection, and socially responsible action. Higher education institutions and academic leaders gain access to a coherent and scalable model for embedding

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sustainability within curricula and quality assurance systems, enhancing institutional innovation, visibility, and societal relevance. Moreover, policymakers and accreditation agencies can adopt the framework as a standardized, empirically grounded reference to support policy coherence, benchmarking, and progress toward common European objectives in sustainability education.

Keywords: Green competencies, digital skills, higher education, sustainability.

1 INTRODUCTION

Embedding sustainability across HE is crucial for preparing future professionals to address the environmental, social, and economic challenges of the twenty-first century. Universities play a key role as catalysts for a sustainable and resilient society. By integrating sustainability competencies into curricula, they can foster systemic thinking, innovation, ethical leadership, and collaboration. This project is funded by the European Commission, through the Erasmus+ program (KA220-HED - Cooperation partnerships in higher education 2024), by the project “GREENVERSITY: PROGRAM FOR THE IMPLEMENTATION OF THE GREENCOMP IN HIGHER EDUCATION”, with reference 2024-1-ES01-KA220-HED-000257362.

Greenversity stands out as a program to a comprehensive and concerted effort aimed at addressing the imperative of bolstering Green Competences (GreenComp) within the HE sector, all while concurrently nurturing excellence in learning, teaching, and skills development. Greeniversity embraces a holistic and forward-thinking triple-bottom-line approach, purposefully aligning its endeavors with the imperatives of environmental, social, and economic sustainability. It is structured into 3 main dimensions:

The FRAMEWORK, in which the European Framework of GreenComp will be deployed and integrated into an affordable and accredited program for HE.

For EDUCATORS by means of a set of digital training center, a Training-of-Trainers (ToT) methodology, an e-course and motivation, recognition and networking initiatives to nurture them to be able to implement the Greeniversity Framework.

To STUDENTS, by means of a set of digital learning centers, a transversal face-to-face course, learning opportunities and networking initiatives to motivate students in upskilling and reskilling their competences under the Greeniversity perspective.

This paper focuses on the first dimension, the Framework, which presents a taxonomized structure of sustainability competences adapted to higher education systems, the Greenversity CORE. It organizes learning outcomes across three domains (knowledge, skills, and attitudes [KSA]) and integrates a three-level assessment rubric to support systematic evaluation and implementation.

2 METHODOLOGY

Greenversity CORE emerged from a process of collective knowledge building and validation based on a mixed-method research design. This iterative and participatory approach ensured the progressive refinement of the framework and the establishment of a shared understanding of sustainability competences in HE. To achieve this, the Greenversity consortium engaged a diverse network of around 20 experts and stakeholders representing academia, research institutions, educators, policymakers, and non-governmental organizations from across Europe. Their insights and feedback were gathered through several consultation rounds to ensure the framework’s conceptual robustness, inclusiveness, and practical relevance. The development process unfolded through several key phases.

It began with a scoping phase, which included extensive desk research and literature analysis to identify existing models, theories, and best practices in sustainability education and competence-based learning. This resulted in the report “Use cases to include sustainability competences in higher education” [2], in which orientations and needs were proposed.

Afterwards, a consultation on the demand side with stakeholders as experts in the social, economic and environmental spheres, was carried out, with a focus on the green skills that are required by green hiring practices. This resulted in the report “Sustainability skills for citizens: demands from the environmental, economic and social spheres”) [3], where a connection of required skills with educational programs resulted in relevant recommendations to induce the cultivation of sustainable leadership and interdisciplinary problem-solving

Subsequently, iterative virtual workshops and meetings focused on the thorough understanding of the Greencomp and the need to implement and adapt to the HE offered the initial proposal of competence areas and components, structured as a draft version of the Greenversity CORE.

Next, collaborative workshops brought together experts in sustainability education and lifelong learning to review, debate, and refine the preliminary draft. Each competence was articulated through statements describing the required KSA, which served to clarify its scope and facilitate its application in curriculum design and assessment. Further iterations of the framework incorporated continuous feedback and validation from stakeholders, ensuring that the resulting model is both conceptually sound and operationally feasible across different areas of knowledge.

Building upon this foundation, the Greenversity team developed a three-level rubric system to guide the assessment of each KSA dimension. These rubrics describe progressive levels of mastery—ranging from basic awareness to proficient and advanced integration—and provide concrete descriptors to help educators evaluate student performance consistently. Designed as practical tools, the rubrics aim to simplify the adoption of the framework, enabling educators to embed sustainability competences into course design, assessment strategies, and institutional quality processes with ease.

Finally, the framework underwent continuous refinement through ongoing feedback and validation activities with partner institutions and external experts. This process helps ensure that the final Greenversity CORE Framework can be conceptually sound and operationally feasible, offering universities a coherent, adaptable, and user-friendly model for embedding sustainability competences across disciplines and fostering systemic thinking for a sustainable future.

2.1 Target audiences and potential uses

The Greenversity CORE is offered to the whole HE System, and therefore, different agents of the teaching-learning process are directly focused:

- University Educators and Teaching Staff. Educators are central to embedding sustainability competences in HE. The Greenversity Framework provides structured learning outcomes and rubrics that guide the integration of sustainability across disciplines. It enables educators to design competence-oriented courses aligned with European standards while preserving disciplinary autonomy.
- Curriculum Designers and Academic Coordinators. For curriculum designers, the framework functions as a strategic instrument for embedding sustainability throughout degree programs. It offers a standardized yet flexible model that aligns program-level outcomes with sustainability goals and supports curriculum mapping, evaluation, and accreditation processes, ensuring transversal coherence across disciplines.
- HE Institutions and Quality Assurance Bodies. At the institutional level, Greenversity serves as a reference for governance and quality assurance in sustainability education. It supports the development of evaluation and accreditation standards recognizing sustainability competences as fundamental learning outcomes, strengthening institutional coherence and accountability.
- Policymakers and Educational Authorities: Greenversity provides a coherent, evidence-informed structure that aligns HE policies with European sustainability agendas. It guides national and regional curriculum and accreditation strategies, supporting harmonization, comparability, and the translation of policy commitments into educational practice.
- Students and Learners. Students benefit directly from the framework's competence-based approach, gaining KSA for sustainability-oriented action. Transparent rubrics enhance self-assessment, motivation, and agency, empowering learners to contribute to sustainable transformation in academic, professional, and civic contexts.
- Employers and Industry Partners. Greenversity offers a shared reference for identifying sustainability competences relevant to the labour market. It helps employers recognize and value graduates' abilities in systemic thinking and responsible innovation, aligning education outcomes with evolving green economy demands.
- Non-Governmental Organizations (NGOs) and Civil Society Organizations. For NGOs and civil society, the framework provides an educational reference to collaborate with academia in promoting sustainability learning and outreach. By adopting a shared competence model, these organizations enhance the credibility, coherence, and impact of their initiatives, fostering partnerships that bridge academic knowledge and societal change.

2.2 Structure of the report

The report is structured to guide the reader from the broad conceptual foundations of sustainability education to the practical application of the Greenversity CORE Framework, which represents the center outcome of this report. It is organised into a coherent sequence of sections that progressively build understanding—from theory and context to implementation and reflection.

The opening section provides a general overview of Education for Sustainability, positioning it within the wider context of global environmental and societal challenges. It discusses sustainability as a systemic and interconnected issue, emphasizing the need for transformative learning approaches capable of addressing complex and interdependent phenomena such as climate change, biodiversity loss, and social inequity. This section sets the theoretical foundation upon which the rest of the report is built, aligning the educational mission with the principles of systemic thinking and transformative education.

The following section traces the evolution of Education for Sustainable Development (ESD) to the GreenComp Framework, which serves as the European reference for sustainability competences. It outlines the structure, objectives, and methodological underpinnings of GreenComp, highlighting its role in shaping educational policy and practice across Europe. This discussion provides the necessary background to understand how Greenversity builds upon and extends GreenComp's foundations, adapting them to the specific needs and contexts of higher education.

At the heart of the report lies the Greenversity CORE Framework, which constitutes its central contribution. This framework translates the overarching GreenComp competences into a set of transversal sustainability competences tailored to university education. Each competence is systematically taxonomised into three dimensions—knowledge, skills, and attitudes (KSA)—that together provide a comprehensive representation of what it means to be competent in sustainability. To facilitate implementation and assessment, each KSA component is accompanied by a three-level rubric that describes progressive stages of mastery, enabling educators to evaluate learning outcomes with clarity and consistency.

The subsequent section provides practical tips for implementation, offering examples to support educators in embedding the Greenversity competences within existing academic structures.

Finally, the report concludes with a section of concluding remarks that synthesizes the main insights and reflects on the broader implications of the Greenversity Framework. This closing discussion underscores the importance of integrating systemic sustainability competences into HE as a strategic step toward shaping universities capable of leading the sustainability transition.

3 RESULTS

The working definition adopted in this report is "Sustainability means prioritising the needs of all life forms and of the planet by ensuring that human activity does not exceed planetary boundaries". These planetary boundaries refer to the nine Earth system processes: climate change, biosphere integrity, land-system change, freshwater use, biogeochemical flows (nitrogen and phosphorus cycles), ocean acidification, stratospheric ozone depletion, atmospheric aerosol loading, and the introduction of novel entities such as chemical pollution. Those must be monitored, as they are negatively affected by human activities, primarily driven by fossil fuel use.

By integrating the knowledge of these boundaries and skills to recognise challenges and implement solutions into educational curricula, students and citizens can develop a clear understanding of the limits within which humanity must operate to maintain Earth's stability. This knowledge fosters awareness and responsibility, empowering actions to reduce, mitigate, or retrofit human impact on these critical Earth system processes. Sustainability education encourages systems thinking, helping learners see the interconnectedness of environmental challenges and the importance of adopting sustainable lifestyles and policies. Through informed education, societies can drive transformative changes needed to respect these boundaries, ensuring a safer and more resilient future for the planet and all its inhabitants. This underscores education's role as a foundational tool in sustainability efforts to help humanity live within planetary limits and promote long-term ecological balance.

3.1 The GREENVERSITY CORE

This work has been developed based on extensive knowledge and prior studies conducted by the project partners [2–4]. It notably integrates a thorough analysis of the needs from both the demand side—

represented by stakeholders aligned with the Triple Bottom Line perspective—and the supply side, consisting of universities offering sustainability education. This collaborative approach ensures that the framework is grounded in real-world requirements while addressing educational provisions, thereby creating a balanced and comprehensive foundation for advancing sustainability competencies in HE.

The analysis of green hiring practices proposed that the integration of Triple Bottom Line competencies ensured that students, professionals, and citizens develop a comprehensive set of skills essential for driving meaningful sustainability transformations at both local and global scales. If graduates are equipped with a broad spectrum of cognitive, interpersonal, and practical skills—e.g., from systems thinking and critical thinking to ethical responsibility—that prepare them for adaptive, future-focused leadership. Embedding these competencies throughout curricula not only enhances professional readiness but also empowers individuals to contribute effectively to the UN Sustainable Development Goals through informed and responsible actions.

Greenversity project included an analysis of use cases in HE focused on programs on sustainability education, emphasizing the necessity of a comprehensive strategy that transforms all key stakeholders—faculty, administration, and students—from passive compliance into active ownership and systemic engagement. It highlights the critical need for specific instructions, templates, and resources to guide educators in effectively implementing sustainability competencies. These practical tools need to include a structured framework tailored to HE contexts, clear learning objectives aligned with the GreenComp framework, and customizable curriculum design templates.

As a result, the "GREENVERSITY CORE: The Framework of competences and evaluation criteria to implement sustainability-driven mindset in higher education" has emerged through an ongoing, rigorous process of revision and dialogue among a diverse group of experts, nurtured by previous needs analysis. Its development is rooted in a careful examination of etymology and consensus-building achieved through structured work groups and inclusive decision-making processes. This collaborative effort ensures that the CORE framework is grounded in shared understanding and collective agreement, reflecting diverse perspectives and expertise. Such iterative engagement drives the framework's robustness and adaptability in addressing complex sustainability challenges. Table 1 shows an example for the area, specifically in 1,1 Valuing Sustainability.

Table 1. Example of evaluation rubric for the first part of area 1 (Embodying sustainability values)

Green competence	***1.1 Valuing sustainability***
General definition	To reflect on personal values; identify and explain how values vary among people and over time, while critically evaluating how they align with sustainability values
Knowledge objective	To understand that sustainability is shaped by diverse and sometimes conflicting value systems, and can describe how worldviews —such as anthropocentric, technocentric, and ecocentric—, cultural, generational, and socioeconomic factors influence sustainability perceptions and decisions, while recognizing that inclusive engagement across all value systems is essential.
Rubric: sentence for level 0	Shows limited or fragmented understanding; may identify one or two influences (e.g., a worldview or cultural factor) without connecting them to sustainability in a meaningful way.
Rubric: sentence for level 1	Demonstrates a clear understanding that sustainability is value-based and influenced by different worldviews and sociocultural contexts; can provide basic explanations and examples.
Rubric: sentence for level 2	Demonstrates a deep and integrated understanding of how multiple worldviews (e.g., anthropocentric, technocentric, ecocentric), cultural backgrounds, generations, and socioeconomic positions shape sustainability perspectives; provides insightful examples and connections.
Skills objective	To demonstrate the ability to critically assess, compare, and deliberate on different sustainability values and principles, integrating these into personal and collective decisions and actions while recognizing environmental impacts and diverse perspectives, and the importance of cooperating across differing worldviews rather than relying solely on one's own values.

Rubric: sentence for level 0	Shows limited ability to identify or analyse sustainability values. May recognise environmental impact superficially but struggles to assess values or integrate them into decision-making or action. Considers few or no alternative perspectives.
Rubric: sentence for level 1	Can identify and compare sustainability values and principles in a clear and structured way. Recognizes environmental impacts and demonstrates the ability to reflect on personal actions and decisions. Considers multiple perspectives with some depth.
Rubric: sentence for level 2	Consistently and critically assesses, compares, and deliberates on sustainability values in diverse contexts (e.g., actions, policies, arguments). Integrates these values into well-justified decisions and actions. Demonstrates strong awareness of environmental impacts and the ability to engage with diverse and conflicting perspectives constructively.
Attitude's objective	To demonstrate openness to critically reflect on personal values, respects diverse cultural perspectives, and adopts a reflective, inclusive attitude grounded in sustainability principles.
Rubric: sentence for level 0	Shows limited openness to reflect on own values and their sustainability implications; engagement with diverse perspectives is superficial or reluctant.
Rubric: sentence for level 1	Reflects on personal values with reasonable openness and shows respect for diverse cultural perspectives; demonstrates willingness to act according to sustainability principles.
Rubric: sentence for level 2	Actively and thoughtfully scrutinizes own values and their sustainability impact; embraces and values cultural diversity critically and inclusively; consistently adopts a reflective, open, and sustainability-centred attitude in decisions and actions.

3.2 Tips for implementation

The upcoming publication Greenversity PATHWAY will serve as a structured and practical guide to support educators in implementing the Greenversity CORE framework within higher education. It provides methodological guidance for integrating sustainability competences into curricula and for ensuring standardized accreditation of programs adopting the framework, thereby promoting coherence, quality, and institutional recognition. The proposed pedagogical strategies emphasize fostering ethical reflection, embracing systemic and interdisciplinary thinking, envisioning sustainable futures, and encouraging transformative, action-oriented learning. Overall, it will advocate for the integration of a sustainability-driven mindset across teaching practices without requiring major curricular changes.

Further information will be available through Greenversity project reports on the official website and the Zenodo repository (www.greenversity.eu , https://zenodo.org/communities/greenversity).

4 CONCLUSIONS

Embedding sustainability across HE is essential for equipping future professionals with the competences needed to address today's complex environmental, social, and economic challenges. This integration fosters systemic thinking, ethical reflection, innovation, and collective responsibility, enabling universities to act as transformative agents in advancing global sustainability transitions. Within the policy framework of the European Green Deal, the Joint Research Centre (JRC) developed GreenComp: The European Sustainability Competence Framework, which defines a comprehensive set of sustainability competences aimed at cultivating knowledge, skills, and attitudes to think, plan, and act responsibly for the planet and society. It was open for all levels of education, with an invitation to adapt to particular contexts.

The Greenversity initiative accepted this invitation and created the Greenversity CORE, a framework specifically designed for higher education. It translates GreenComp's four competence areas—embodying sustainability values, embracing complexity, envisioning sustainable futures, and acting for sustainability—into an academic context applicable across disciplines. Developed through an iterative, participatory process that engaged experts and stakeholders, the CORE ensures conceptual precision, shared understanding, and adaptability. Each competence is articulated through knowledge, skills, and attitudes, supported by clear assessment rubrics to guide implementation and evaluation.

By integrating the Greenversity CORE, higher education institutions can embed sustainability competencies within existing curricula, fostering coherence and continuity without major structural changes. Its adoption strengthens the transformative potential of university education, preparing students to become proactive agents of change. Ultimately, the Greenversity CORE enhances the quality, relevance, and societal impact of sustainability education, reinforcing universities' pivotal role in shaping an equitable and resilient future.

The document can be consulted in Echegoyen-Sanz, Y., Puurtinen, M., Mykrä, N., Gil, P., Vinha, B., Grecu, V., Emorine, A., Serra-Añó, P., & Badia Valiente, J. D. (2025). GREENVERSITY CORE: The Framework of competences and evaluation criteria to implement sustainability-driven mindset in higher education. Greenversity Project (2024-1-ES01-KA220-HED-000257362). https://doi.org/10.5281/zenodo.17722436.

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