# MEASURING KNOWLEDGE OF YOUTH ABOUT SUSTAINABILITY AND CIRCULAR ECONOMY

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**Abstract.** Youth awareness and knowledge about sustainability have become increasingly important, as younger generations play a critical role in shaping a sustainable future. Many young people may already be aware of sustainability issues, such as climate change, plastic pollution, deforestation, waste management due to widespread media coverage, social media and school curriculums, however, the depth of understanding varies based on education, location, and access to information. Sustainability issues are included in the curricula even from a very early stage of education but it is essential to find the most proper and most efficient educational methods for the different levels and ages to achieve real development in the society. Our paper refers to the results of a primary research carried out among university students and teachers in 6 European countries (Bulgaria, Cyprus, Hungary, Italy, Spain and Portugal) within the framework of the SustainEd project (Project ID: 2023-1-HU01-KA220-HED-000165475). The overall goal of the project is to develop and implement a sustainable learning program for university students that combines living labs and WebQuests to enhance their understanding of sustainability and circular economy concepts, develop their green skills and competencies, and prepare them for effective participation in the green transition, contributing towards the achievement of SDGs. In our paper we intended to analyse how much university students and lecturers know about the innovative teaching methods used and whether those methods can be efficiently used related to the topics e.g. circular economy, green food, sustainable logistics. Based on the feedback of students and lecturers we are convinced that the best way to integrate sustainability into all levels of education is by applying experiential and challenge-based learning methods with a focus on practical solutions, critical thinking, allowing students to learn through experience.

**Keywords:** sustainability, circular economy, youth, SustainEd.

## Introduction

Sustainable development is the overarching paradigm of the United Nations. The concept of sustainable development was described by the 1987 Bruntland Commission Report [1; 2] by the World Commission on Environment and Development (WCED) as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Therefore, sustainability is a paradigm for thinking about a future in which environmental, social and economic considerations must be balanced while a better quality of life is in the focus. However, today we live in an increasingly globalized and interconnected world and new entrants on the market as well as fast changing technologies influence the performance both in resource development and management on a much larger scale than before.

Tennakoon et al. [3] also agree that sustainability practices have undergone significant transformations over the years in response to changing environmental concerns, technological advancements, regulatory pressures, and societal expectations. Early efforts primarily focused on pollution control and compliance with environmental regulations [4]. However, as environmental awareness grew, sustainability practices evolved to embrace a broader agenda, encompassing concepts such as corporate social responsibility, circular economy principles, and the sustainable development goals (SDGs) set forth by the United Nations [5].

Globalization, climate change, the effective and efficient management of available resources as well as their depletion, and the aging of the population, among others, invite societies to change the direction of quantitative economic growth towards a more qualitative and responsible dimension [6].

Our paper focuses on the latest initiatives in teaching methods that are surely able to contribute to a better understanding of sustainability-related issues. The paper also aims to explore the effectiveness of challenge-based learning among students of different educational backgrounds such as STEM, economics, management. By using these methods, education and training of people – also in the rural areas – can be more effective, thus leading to more efficient social involvement in ESG topics.

**Green transformation of education**

As global economies shift from linear to circular economies, the need to build on green skills and competencies becomes critical across sectors and industries, and the role of universities in developing these skills becomes more evident. Universities play a vital role in equipping future professionals and leaders with the necessary knowledge, skills, and experience to pursue green careers and contribute to a sustainable future. The urge for development and promotion of green skills for future generations is emphasized in various strategic documents.

The United Nations Environment Programme (UNEP) reports that human activities have altered over 75% of the Earth's land surface, leading to rapid species extinction, extreme weather patterns, and depletion of natural resources [7]. Addressing these challenges requires a multi-faceted approach, where education plays a central role in fostering environmental consciousness, behavioural change, and policy innovation [8].

The European Commission's Communication on the European Green Deal [9] highlights the importance of developing new skills and competences to support the green transition, particularly in the areas of climate change, energy, circular economy, and sustainable food systems. Similarly, the Sustainable Development Goals (SDGs) Agenda 2030 [10] emphasizes the need for education and capacity-building to support sustainable development, and stresses the role of higher education in equipping students with the skills and knowledge needed to contribute to SDGs. The Green Deal also recognizes the need for interdisciplinary approaches and partnerships between academia, industry, and civil society to promote the circular economy. The Green Skills Partnership, which is part of the Skills Agenda, specifically aims to strengthen the capacity of education and training providers to deliver green skills and qualifications.

The EU Circular Economy Action Plan, adopted in 2020, emphasizes the need for businesses and organizations to adopt circular economy practices, which requires the development of new skills and competencies, including in management and human resources. The Action Plan states that "the transition to a circular economy requires a shift in skills and training needs, and circular skills will need to be integrated into all relevant education and training systems" [11].

Education influences public attitudes, economic policies, and technological advancements that all contribute to sustainability. Environmental literacy equips individuals with the knowledge to make informed decisions about energy consumption, waste management, and conservation efforts. Studies indicate that countries with stronger environmental education policies demonstrate higher sustainability indices and reduced carbon footprints. The United Nations Sustainable Development Goals (SDGs), particularly SDG 4.7, emphasize the integration of sustainability concepts into education systems. Therefore, global efforts have focused on curriculum reform, teacher training, and institutional policies that promote green skills and environmental stewardship over the recent years.

As skills needs are rapidly evolving, the higher education sector has to adapt. The green and digital transitions require future-proof education, research and innovation, in close cooperation with the related industries and stakeholders and the significant disparities in digital skills across the EU must be overcome. Students and staff across the EU need to be equipped with the green and digital skills for the future and the innovation and technological potential of universities needs to be put at work to tackle related societal challenges [12]. Recognizing the importance of all these challenges, the diverse team of the SustainEd project is highly motivated to create practical resources to enhance university students' understanding of sustainability and circular economy concepts, develop their green skills and competencies, and prepare them for effective participation in the green transition.

The call for green transformation of education, business and society is more pressing than ever before [13]. The International Labor Organization has predicted the creation of 100 million new jobs by 2030 ensuring a green transition. The Adecco Group's research paper, Skills for the Green Economy [14], stresses that more than 1.47 billion jobs globally depend on a stable climate, and progressing innovation means that many jobs are yet to be invented, hence the pressing need for green skills development cannot be underestimated. Meanwhile, various EU studies indicate the lack of green skills on various levels:

1. HEI level (HEI students' perspective): just over a one-fourth of HE graduates (27%) are confident in their ability to advise on environmental sustainability and only 1/3 of HE students think that HEIs are doing enough to address climate change.
2. Business level: over 40% of employers in the EU have difficulties finding workers with the right skills, including skills related to sustainability and environmental protection.
3. Macro level: a Eurobarometer survey conducted in 2019 shows that 71% of Europeans believe that they do not have sufficient knowledge about how to live a more environmentally friendly lifestyle [15].

To ensure a workforce capable of driving green transition, HEIs need "a shift towards more interdisciplinary and problem-based learning" (EC, 2020), supported by various HE stakeholders and based on hands-on experience. Based on the aforementioned, the concrete needs to be addressed by HE institutions:

- enhancing HE students' understanding of sustainability and circular economy concepts;
- developing green skills and competencies of HE students and academics;
- preparing HE students and academics for effective participation in the green transition;
- building awareness of the importance of sustainability and the circular economy;
- fostering interdisciplinary collaboration.

Being at the forefront of education, universities fail to address the above challenges due to various reasons:

1. **Outdated curricula** – the majority of higher education programmes are still organised along disciplinary lines, with little integration of sustainability into the core curriculum, whereas addressing nowadays challenges requires a cross-disciplinary approach.
2. **Limited resources and expertise** – many university staff do not feel confident in teaching sustainability and circular economy and many higher education institutions lack the necessary resources to embed sustainability into the curriculum.
3. **Resistance to change** – according to the United Nations Environment Programme, "lack of institutional support for sustainability and resistance to change by academic departments remain key challenges to implementing sustainability education [16]".

To address these challenges, higher education institutions need to incorporate new, innovative teaching methods and information originating from the business players into the curricula and make sure that the knowledge and skills students obtain meet the ever-changing environment [17].

Yet, sustainability is an issue that goes well beyond the domain of education. It is of importance to the business world and to society from a global perspective. The business needs workers with the right set of skills, including sustainability and green skills while society in general would benefit from knowledge about how to live a more environmentally friendly lifestyle. Thus, the SustainEd project has a good potential for creating synergies and impact across different fields of education and training.

## Material and methods

In this study, we employed a mixed-methods approach to assess the effectiveness of challenge-based and experiential learning through WebQuests with living labs elements. Between October, 2024 and February, 2025, a pilot testing phase was conducted with 289 students and 11 lecturers from Hungary, Italy, Spain, Portugal, Bulgaria and Cyprus. As indicated in Table 1 (created by authors, 2025), the sample upon which the conclusions in the next sections are based, comprising 289 higher education students pursuing bachelor's and master's degrees across diverse fields including STEM, humanities, economics, and related disciplines, and 8 higher education teachers specialised in economics, psychology, marketing, logistics, innovation, etc.

Participants engaged with a series of 24 WebQuests specifically designed to promote the development of their green, digital and transversal skills while accumulating long-lasting knowledge on the topics of sustainability and circular economy by learning through experience. Following the completion of the WebQuests, students were asked to complete a structured survey, which incorporated both Likert-scale items and open-ended questions to capture quantitative and qualitative feedback regarding the training materials. The survey focused on assessing usability, engagement, strengths and

weaknesses, and the overall impact on learning outcomes. Lecturers' feedback was gathered through a structured survey combining closed and open-ended questions aimed at gathering qualitative data regarding the effectiveness of the teaching methods tested. Descriptive analysis, deductive and inductive reasoning were employed to analyse the surveys' results and derive the conclusions presented in the subsequent sections of this paper.

Table 1

**Profile of participants in the sample**

| Country | Number of students | Field of studies | Number of lecturers | Subjects of teaching |
|---|---|---|---|---|
| Hungary | 141 | Economics, Marketing, Logistics, Management | 2 | Regional Development, Economics, Logistics |
| Italy | 63 | Management, Engineering | 2 | Energy Management, Digitalisation, Environmental Psychology |
| Spain | 20 | Smart Cities Management | 1 | Open Innovation, Sustainability, Living labs |
| Bulgaria | 29 | Computer and Software Engineering | 1 | Project Management in IT |
| Cyprus | 20 | Tourism and Hospitality Management | 1 | Management and Economics |
| Portugal | 16 | IT, Environmental Engineering | 1 | Entrepreneurship |
| *Total* | *289* | - | *8* | - |

The data from the survey was collected and analysed in Microsoft Excel program and the figures were created in the same. No other statistical methods have been used since the focus of the survey was rather qualitative.

## Results and discussion

In this section we will present the main findings from the perspective of both the students and the lecturers who led the pilot testing actions in the 6 countries. Students have reported the following impressions.

**Improved Skills and Knowledge.** More than 90% of student respondents in all partner countries agreed that the living lab elements and the WebQuests, in general, contributed to improving their skills and knowledge on topics such as ESG and sustainability, sustainable supply chains, sustainable finance, and circular economy business models. This highlights the effectiveness of the combined WebQuest and experiential learning (living labs) methodology. For all tested WebQuests, a significant majority of learners (ranging from 80% to 100% depending on the specific WebQuest and country) agreed or somewhat agreed that their knowledge and skills on the addressed topics improved. Furthermore, many respondents commented that through these activities they managed to get deeper into topics they "touched" in other classes but now they understand them much better indicating they gained a higher level of understanding on topics related to sustainability and circular economy, addressed by the WebQuests.

**Positive evaluation of the practical approach.** A considerable share of the learners praised the practical aspect of the WebQuests and their assignments. They found it very interesting to have to take their projects "outside" the campus, interacting with real companies (living lab element). They felt the training gave them practical experience that will be useful for their jobs and businesses. A student has even commented that they "hope this is the direction education will take in the future" validating that the WebQuests brought added value in their learning experience.

**High General Satisfaction with Training.** As shown on Fig. 1, 97% (207 respondents) of participants across all countries would recommend the SustainEd WebQuests to others and another 97% (206 respondents) confirmed that the training met their expectations and would be useful in their personal and professional lives. Considering that the pilot testing involved students from diverse academic backgrounds (including STEM, economics, and management) and that 97% of participants

found the WebQuests approach beneficial for their professional development, it can be concluded that this method effectively supports learning across a broad spectrum of disciplines.

**Identified Strengths.** Students highlighted several positive aspects of the training experience, including teamwork, the acquisition of new knowledge and perspectives, the practical nature of the activities, the difference from traditional pedagogy, the fun and engaging aspects, the research opportunities, and the development of critical thinking skills.

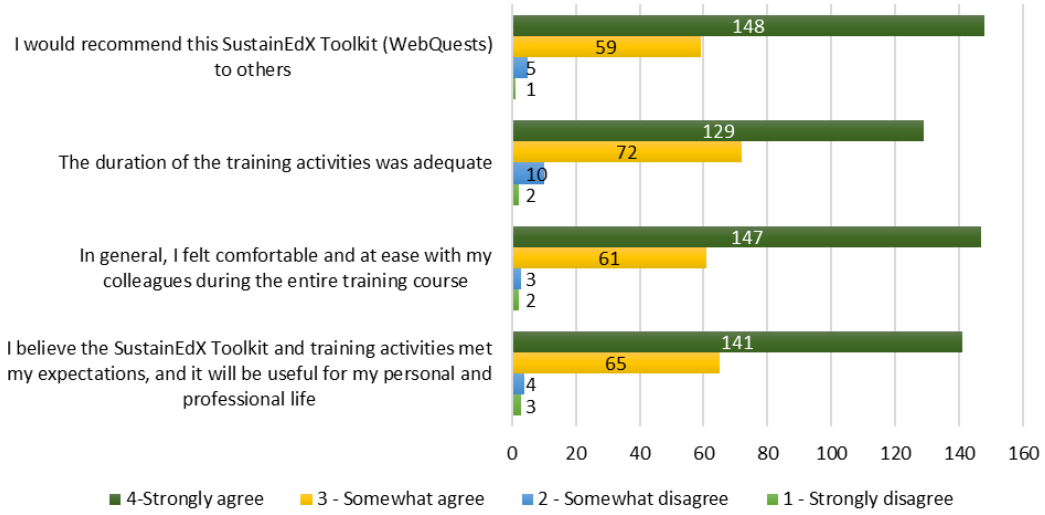


Fig. 1. **General satisfaction with the SustainEdX Toolkit (WebQuests) testing**

Based on the conducted analysis, lecturers have reported the following observations.

- **Increased Student Engagement.** All lecturers who completed the evaluation forms found the SustainEd WebQuests approach to be very effective in engaging students during the pilot testing. They noted that students were more involved in a stimulating yet relaxed atmosphere. Lecturers also witnessed students becoming more active participants, even those who were previously less engaged in traditional teaching settings.
- **Enhanced Student Motivation**. Lecturers who took part in the pilot testing observed that WebQuests motivated students and encouraged everyone to get involved, and even students that are not usually that active in class, were engaged. They saw that students were open to learning new methods and using their creativity, innovativeness, and teamwork abilities, proving that students can be motivated with the proper tools.
- **Improved Knowledge Retention**. One lecturer noted that students learned happily and did not perceive learning as a challenge but as fun, leading to better knowledge retention compared to traditional teaching methods.
- **Connection of Theory to Practice**. Lecturers found that WebQuests helped students connect theoretical knowledge with practical applications. They observed students engaging in critical and creative thinking, collaborating, questioning existing practices, and proposing innovative ideas, demonstrating their ability to link what they learned with real-world scenarios. The hands-on nature of WebQuests was seen as crucial for learning.
- **Development of Transversal Skills**. Lecturers highlighted that the WebQuest approach fostered the development of skills beyond just the subject matter, such as creativity, innovativeness, and teamwork.

Lecturers themselves found the experience positive, with some noting that it allowed them to see a different aspect of their students and step outside the traditional teaching approach. One lecturer, who teaches project management in IT, found WebQuests to be very appropriate for the subject and intends to use the method in the future. Similar studies have also proven that challenge-based activities such as WebQuests contribute to knowledge retention also when it comes to teaching complex technical concepts [18] and foreign languages [19] to engineering students as well, which underlines the potential for transferability of this constructivist method across STEM disciplines as well [20].

Benchmarking the students' and teachers' perspectives we observed both share the opinion that WebQuests are particularly effective in generating long-lasting knowledge on the topics of sustainability, circular economy and related subjects. This constructivist teaching method makes learning more fun, engaging and effective, motivating even less active students to take ownership of learning while contributing to the development of transversal skills.

## Conclusions

The findings of this study support several key conclusions regarding the effectiveness of WebQuests as a pedagogical tool for teaching sustainability and circular economy concepts.

1. WebQuests have demonstrated their efficacy in facilitating active learning, not only in sustainability education but also in other disciplines. Previous research further confirms their positive impact, particularly among students in engineering and technical fields.
2. This constructivist approach is highly adaptable and accessible to students from diverse academic backgrounds, including STEM, economics, and humanities, highlighting its transferability across disciplines.
3. Challenge-based, practically oriented learning methodologies enhance student motivation, fostering engagement even among typically less active learners.
4. Engaging with WebQuests stimulates critical and creative thinking, enhances teamwork skills, and creates a memorable and meaningful learning experience, contributing to improved knowledge retention.

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## Author contributions

Conceptualization, H. N. and A. B., methodology, A. B. and H. N., investigation, H. N. and A. B., data curation, A.B., H. N., writing – original draft preparation, H. N., writing – review and editing, A.B. and H.N., visualization, H. N. and A. B., project administration, H. N. and A. B., funding acquisition, H.N. and A. B. All authors have read and agreed to the published version of the manuscript.

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