Soft Skills for Green Transition

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Abstract

Climate change is progressively changing the nature of work in various occupations and the skills required of many workers, even in the STEM fields. Education at all levels, including higher education, should face these changes, adapt to new challenges and conditions, and change its approach to teaching. Traditionally, hard skills have been considered essential, yet several studies highlight the crucial role of soft skills in rapidly changing work environments. Therefore, developing these skills as part of a holistic approach to the 'greening' of the economy is essential for educators, as their students are future workers and potential change agents in the green industry. At the same time, more knowledge about the context in which soft skills are used is of great interest.

The findings of this research provide some interesting insights for STEM educators: soft skills are widely recognised, but some of them, such as communication, empathy, problem-solving, and metacognition are particularly useful as the green transition essentially involves changing mindsets, working in multidisciplinary environments, and influencing employees and customers. The connection with industry stakeholders as co-designers or simply contributors to the learning experience, and collaboration between faculties, fostering transdisciplinarity, can be a lever to develop such skills.

Keywords: Green transition skills, STEM education, Soft skills in green transition, Green transition skills gaps, Sustainable development

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Introduction

The research conducted within the SOFTEN project (‘Embedding SOFt skills in sTem academic curricula for the transition to sustainable grEeN economy’ www.softenproject.eu - an international educational project co-funded by the European Union under the ERASMUS+) recognized that one of the major challenges our society must face is to adapt to climate change Meeting the requirements of the ‘green transformation’, intended as the transition of the economy and society towards achieving climate and environmental goals, primarily through policies and investments, and striving to develop the so-called 'green economy', described as management that helps improve human well-being and reach social equality while reducing or eliminating environmental risks and ecological deficiencies.

In such conditions, 'green jobs' are created, which include occupations that facilitate the achievement of net zero emissions goals and other environmental goals (e.g. restoring the balance in nature, adapting to climate change, caring for biodiversity, etc.). In this context, the concept of "green soft skills" becomes relevant, covering knowledge, skills, values, and attitudes important for human existence and social development, consistent with sustainable development (Galani et al. 2023; Rieckmann 2018). This is not about special new soft skills, but rather about their adaptation and “interpretation” in a direction useful for implementing the principles of sustainable development in practice and building a greener economy.

Materials and Methods

The basis of this paper is a research addressed to STEM educators and companies in the green sector in six European countries: it highlights the status and teaching practices of soft skills in STEM higher education, as well as the barriers experienced by educators. Secondly, the research explores how soft skills and their role in the green transition are perceived in the green industry and in which specific situations are essential.

Given the lack of soft skills among STEM graduates reported in previous studies, the research investigated the perception of different stakeholders about soft skills development in STEM faculties and their incorporation within current curricula. In addition, pedagogical practices for their development have been examined. Third, the challenges and barriers to effectively integrating these skills were also explored.

To investigate, map, and identify in-depth current trends, opportunities, needs, and gaps in the level of soft skills’ integration and application in contemporary STEM academic programs and green industries, a mixed methodology was applied through a series of three interconnected research activities within six European countries (Greece, Italy, Finland, Poland, Portugal, Lithuania) during the spring and summer 2023. Three target groups were reached out to participate in the research activities, more specifically STEM educational providers (professors, assistant professors, lecturers, etc.,) STEM students from different departments and schools, and green industry stakeholders (e.g., CEOs, employees, employers, directors, etc.), again through a variety of green economy fields (e.g., circular economy, eco-entrepreneurship, clean energy, etc.).

A mixed-methods approach was selected to ensure a good representation of all targeted stakeholders, increase their engagement, and enrich the research findings with as much significant information and insights as possible, about their needs and level of awareness of the examined issue.

The implemented research activities included:

1. A desk research activity in each of the six countries, with the aim to identify and map trends, opportunities, limitations, and good practices regarding soft skills' integration in several STEM university study programs in each country.

2. The application of a qualitative method, through the organization and implementation of semi-structured interviews for educational providers and academic staff from STEM faculties, and professionals from green industries. The main objectives of the interviews were the following ones: 1) to understand the level of awareness of the two previous target groups about soft skills and their perception of the importance of these skills for green transition, 2) to identify barriers and obstacles regarding the integration of soft skills in their STEM departments and gaps that impact negatively on the adaptability of employees to sustainability & green processes, 3) to capture their opinion about the driving factors for soft skills development, in relation to the green transition, within STEM curricula and identify any existing initiatives and benefits of soft skills from green professionals towards the cultivation of a more inclusive green mindset.

3. The application of a quantitative method, through the development of two online surveys, distributed to STEM educators and students from different technical departments and fields. Through online questionnaires these two groups were given the chance to assess the level of knowledge on soft skills' incorporation and development in their studies - field of expertise and highlight their needs and existing gaps about the embeddedness of soft skills in green education in STEM curricula. In addition, both groups were asked to rate their preference about possible pathways, educational tools and training methods that could enable the effective integration of soft skills in STEM curricula for improving their green thinking under an interdisciplinary and more holistic approach.

The collection of primary data offered a direct opportunity to understand the needs and preferences of targeted participants on soft skills' integration, the level of their familiarization with soft skills, and their connection with the green transition and green economy, mainly in relation to STEM graduates' future career.

For the selection of participants for interviews and surveys, a combination of invitations and snowball technique (Robson & McCartan, 2016) were deployed, in order to capture gaps and needs in soft skills and successfully perform the planned research tasks. The involvement of private sector stakeholders from green companies was proven essential in the project for gaining insight into the green soft skills demanded by green businesses.

All collected results were analyzed and included in a framework report (SOFTEN framework), developed as the final product of all research activities and subsequent findings. It describes the state of the art, gaps, limitations, and existing practices from all targeted stakeholders in six European countries.

Results

The research offers some main findings, highlighting the role of soft skills in STEM education and green industries. Despite the recognition of soft skills, as complementary to other field-related skills, the research indicates that approaches in the participating countries differ in many aspects.

Recognition of soft skills in Higher Education Institutions

The 26 interviews conducted with the academic staff revealed a quite high level of familiarity with soft skills, with no significant differences between countries (Table 1). The majority of educators also agreed that students consider soft skills to be very important to acquire during their studies. Despite this consideration and students' expectations, there were differences in all countries in terms of how universities were taking concrete systemic action to integrate the development of these skills into their school and departmental curricula. Only in Finland and Italy does it seem that soft skills have been quite well integrated through a systemic action involving the whole institution. In other countries, despite the general agreement that soft skills are important for the development of a STEM professional, their integration into curricula often occurred as isolated initiatives, by single departments or faculty members in specific courses.

Target groups	Level of familiarity with soft skills
STEM educational providers	FI: 4,4 EL: 4,3 IT: 4,8 LT: 4,1 PL: 4,2 PT: 4,0

Table 1 – Rating of academic participants on introductory interview questions.

The lack of support of top management is one of the major barriers that slow down an effective student's soft skills development process: it has been indicated by all educators interviewed in all countries. Pavlova (2018), for the VET sector, refers to "factors at the system level" that delay or hamper soft skills development: assessment mechanisms not in place, low demand (or none at all) for such skills, no commitment by academic staff and by administrations.

Further, the research reveals that small-scale initiatives have flourished in all six countries regarding the advancement of soft skills in STEM departments' curricula. This is a positive sign indicating that the transition towards more integrated academic programmes in STEM schools has kicked off. However, it is worth stressing that in these initiatives, the explicit linkage of soft skills with a sustainable green transition is often missing, or at least it is not straightforward enough.

Overall, the results confirmed previous findings (Bonwell & al., 1991; Felder, 2000; Prince, 2004; Freeman et al., 2014) in the sense that the development of soft skills is usually effective when integrated into a technical course, through the implementation of new collaborative and interdisciplinary methods that can engage students in practicing these skills. This suggests that the achievement of soft skills should be included in the curriculum and among the intended learning outcomes of the courses, and should be assessed in the same way as hard skills.

Recognition of soft skills in Green industry

In industries, the perception of soft skills shows a rather high variety, which can be seen as natural due to cultural and historical differences. However, the familiarity with soft skills varies from country to country and seems to be in line with the perceived importance of soft skills in relation to the green transition. It is noticeable that in all countries, except for Portugal, this received values exceeding 4,0.

With respect to this, it is somewhat concerning that the green industry confirmed the lack of soft skills in graduates and younger professionals, a finding already reported earlier (e.g., Mourshed et al., 2014; Karimi & Piña, 2021; Singh Dubey et al., 2022). In the presence of this skills shortage, it seems evident that besides educational institutions, also employers have to share this responsibility for their employees' soft skills gaps and to be ready to contribute with actions to the solution of this problem.

As for the practical role and importance of soft skills, the research offers various indications of novelty. First, engaging in the realm of green transition typically entails interdisciplinary collaboration, necessitating communication with individuals from diverse fields of expertise and consequently, different professional mindsets. Besides communication skills, empathy, problem solving, goal-orientation and other non-technical skills are needed in order to succeed. Second, given that green transition involves perpetually shifting parameters within work environments, it requires intrapersonal skills that facilitate the ability to alter one's mindset and adapt to these changes. Based on this research, green soft skills include teamwork, adaptability, communication, collaboration, metacognition, open-mindedness, empathy, critical thinking, and problem-solving complementary to environmental awareness and social consciousness. The evidence obtained from the green industry shows that in various practical contexts, soft skills have a potential leverage effect, proposing them as an element of success in green transition. They enhance the ability to communicate, collaborate, innovate, and lead effectively in the pursuit of a more sustainable future. As the world increasingly recognizes the importance of environmental sustainability, the value of these skills will continue to grow.

Target groups	Level of familiarity with soft skills	How critical are **soft skills** considered for **green transition** and green companies?
Green industry stakeholders	FI: 4,6 GR: 4,6 IT: 4,6 LT: 3,3 PL: 3,5 PT: 3,8	FI: 4,6 GR: 4,0 IT: 4,7 LT: 4,2 PL: 4,0 PT: 3,6

Table 2 – Rating of green industry participants on introductory interview questions

However, the relatively small number of organisations (30) cannot objectively represent the views of the participating countries.

Self-Awarness - Awareness - Knowledge - Action …and Gen AI

In the frame of the project, a university teacher-centered strategy has been formulated to address all the obstacles to the widespread adoption of green soft skills, such as the low importance attributed to soft skills by STEM university students, the reluctance of STEM university teachers to include these skills in their courses, and the lack of those skills among new young employees. One of the pillars of this strategy is teacher training.

“Green Soft Skills for transitioning towards a Sustainable Future” is a Massive Online Open Course for STEM university teachers and educators. It aims at creating awareness of the importance of soft skills for students, not only during university years but, in particular, when they start working. It offers an overview of those skills that can be useful in green industries or in green processes and describes techniques and methodologies that teachers can adopt in their courses, to let students develop soft skills.

The adopted soft skills classification is that elaborated by Schleutker (2016), so the MOOC is organised in 6 weeks: the first one is a general introduction to soft skills for the green transition, then self-management, creativity, communication, and teamwork are presented through methodologies and techniques that teachers can adopt during their lessons, to engage students and let them also acquire transversal skills. The last section is dedicated to innovative pedagogies to foster soft skills, in particular Service Learning and Design Thinking.

Accordingly, the general objective of the MOOC is to present a set of tips and tools, applicable both in large and small classrooms, both with students in 1st university year and with students at the end of their curriculum, both in traditional context with static tables and chairs and with movable furniture. As such, the MOOC represents a long overdue endeavor to find solutions to develop these skills, rather than reflecting on the character of soft skills and, in particular, green soft skills.

To create the videos for this MOOC, some artificial intelligence tools have been experimented with: the content was entirely written by the authors, as were texts, tables, infographics, and reading suggestion lists. Generative Artificial Intelligence has been "engaged" to create the avatars to be used as speakers for video-clips, i.e. those who illustrate some of the teaching techniques proposed in the course. So in the MOOC videos, the avatars Anna and Justin lead the participants to discover some straightforward and intuitive tools that can involve students in active learning.

For each of the techniques proposed in the MOOC videos, a Methodology card is available, i.e. a downloadable template in an editable format that proposes the presented technique with more details, offering some suggestions on how to prepare and manage it in the classroom.

The secret ingredient of "Green Soft Skills for transitioning towards a Sustainable Future" is metacognition: starting from the beginning of the learning path, MOOC participants are involved in activities that gradually make them reflect about their learning choices, their learning styles, and the level of comprehension of the topics.

For each skill, participants pass through:

1. a level of self-awareness, because talking about soft skills concerns everyone and sometimes one is very condescending towards oneself, convinced that it is not necessary to be trained;
2. a level of awareness, about the real willingness to putting into practice and experimenting but also about the specific context assets;
3. a level of knowledge, with the possibility to go deeper if they prefer to read some detailed explanations, and
4. a level of action, thanks to some activities oriented to let instructors apply the concept in their specific context and design their new courses.

Conclusions

Despite the recognized acknowledgment of soft skills, fluctuations in the overall level of awareness between countries are observed. In some countries the role of soft skills is perceived clearly higher by both educators and the green industry, whereas they seem less acknowledged in other countries. This calls for customized awareness when raising campaigns and initiatives, always with respect to the historic and cultural backgrounds of each nation.

However, can we talk about "green soft skills" (see e.g., Farao et al., 2023)? In the absence of relevant literature, ChatGPT suggests the following definition: "Green soft skills are a set of cross-cutting competencies that combine social, behavioral, and cognitive skills with environmental awareness and sustainability. These skills are essential for addressing current challenges related to the environment and climate change and are increasingly in demand in the workplace for addressing sustainability-related challenges, enabling individuals to make meaningful contributions towards protecting the environment and building a sustainable future." (OpenAI, 2023)

On the basis of this research, green soft skills include teamwork, adaptability, communication, collaboration, metacognition, open-mindedness, empathy, critical thinking, and problem-solving complementary to environmental awareness and social consciousness. The evidence obtained from the green industry shows that in many contexts, soft skills have a potential leverage effect, proposing the industry an element of success in the green transition. It is evident that green soft skills enhance managers´and professionals´(the) ability to communicate, collaborate, innovate, and lead effectively in the pursuit of a more sustainable future. As the world increasingly recognizes the importance of environmental sustainability, the value of these skills will continue to grow.

So, integrating the development of green soft skills into school and university curricula is essential for preparing students to meet the challenges of a sustainable future. Such integration should be not only in charge of the teachers but also of the institutions. MOOC running (by the end of 2024) and the development of the other tools scheduled by the project to support STEM educators, could add further inputs to the research.

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In the production of this MOOC some "green" practices have been adopted to limit the impact on the environment:

- the number of videos has been limited to the necessary: in fact, these require a long production process (recording, editing, publishing), and much more energy is required to watch a video than to read a text;
- the document has been shared online instead of being sent by email;
- a Generative AI tool has been used to create avatars to represent the content experts, thus eliminating the travel required to record the videos at the studios of the team in charge of this activity;
- existing online resources have been shared, after carefully selecting videos, articles, websites, and tools, instead of creating all the content from scratch.

Among the Green Soft Skills the team implemented were creativity, team management, and collaboration.

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