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Articles

Green Skills and Master Training: A Case Study

Competenze green e formazione nei Master: un caso applicato

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Abstract

This article analyses a case study that integrates green skills education into Master's programs, focusing on *green transition* education and developing skills and professionals in sustainability. Data from the study demonstrate the positive impact of green skills education on participants. The results provide insights for curriculum design, pedagogical approaches, and institutional policies to empower students with the necessary skills to address environmental challenges. The research also emphasises the positive impact of training on green skills. The implications of this research extend well beyond academia, as developing green skills is crucial for individuals wishing to contribute to the environmental transition and promote sustainability in their future careers.

Keywords: sustainability; green skills; education; master students.

Sintesi

Questo articolo presenta un caso di studio applicato nell'ambito della formazione in materia di competenze green nei programmi di formazione universitaria superiore, con un focus sull'educazione alla *transizione verde* al fine di sviluppare competenze specifiche per i professionisti che operano a favore della sostenibilità. I risultati forniscono indicazioni per la progettazione di curricula, approcci pedagogici e politiche istituzionali per dotare gli studenti delle competenze necessarie per affrontare le sfide ambientali. la ricerca evidenzia anche l'impatto positivo della formazione sulle competenze verdi. Le applicazioni di questa ricerca vanno ben oltre il mondo accademico, in quanto lo sviluppo di competenze green è fondamentale per coloro che aspirano a contribuire alla transizione ambientale e a promuove la sostenibilità nelle loro carriere future.

Parole chiave: sostenibilità; competenze *verdi*; istruzione; studenti master.

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1. Introduction

Sustainability has become a pressing global issue, requiring urgent action from individuals, organisations, and governments. Sustainability is the buzzword of the United Nations' 2030 Agenda, aiming to set the direction for global industrial policy and structural change, focusing on driving innovation and redefining the priority of social and environmental priorities, economic models and living behaviours (Saramin et al., 2024).

The theme of sustainability, when considered in all its aspects – environmental, social, financial, and cultural (UCLG, 2010; Unesco, 2018) – is increasingly recognised as a critical driver. Universities are crucial in preparing future leaders and professionals capable of contributing to sustainable development. This study explores the pedagogical aspects of integrating sustainability education into master's programs, particularly emphasising green skills and holistic human formation (Rieckmann, 2018). Green skills, encompassing knowledge, skills, values, and attitudes necessary for sustainability, are crucial in preparing individuals to navigate the complexities of the 21st century and promote a sustainable and resource-efficient society (PNRR, 2021). Integrating sustainability education into master's programs help bridge the knowledge gap by providing students with a comprehensive understanding of environmental, social, and economic issues.

At the European level, there are references for capacity development actions that consider recently developed competence frameworks to provide individuals with the tools to address societal challenges (OECD, 2014). This knowledge equips them with the foundation to make informed decisions and contribute to sustainable solutions. Sustainability education encourages students to think critically and develop problem-solving skills. Students learn to analyse complex issues, consider multiple perspectives, and develop innovative solutions by engaging in real-world sustainability challenges.

This fosters their ability to address sustainability challenges in their future careers. Sustainability issues are multifaceted and require interdisciplinary approaches. By integrating sustainability education into master's programs, students from different disciplines can collaborate and learn from each other's perspectives (Lozano et al., 2017). This interdisciplinary collaboration enhances their ability to tackle complex sustainability challenges effectively. Green skills like environmental management, renewable energy, and sustainable design are essential for addressing sustainability challenges. The recognised University Social Responsibility (USR), which pays attention to society's needs and drivers of change (Shek & Hollister, 2017), requires the universities and institutions of higher education providers also to adopt an innovative educational model which is not based on the transmission of knowledge but is functional in the building of social thinking.

Integrating these skills into master's programs equips students with the practical knowledge and competencies to implement sustainable practices in their respective fields. These are the key factors underlying a holistic approach to development, which places human beings and their capabilities at the centre (Nussbaum, 2012; Sen,1989), starting from a concept of sustainability as a balance between environmental preservation, social justice, economic development, inclusion and democratic participation. Sustainability education goes beyond technical knowledge and skills. It also emphasises the development of ethical values, empathy, and a sense of responsibility towards the environment and society. This broader human formation enables students to become responsible global citizens who can contribute to a more sustainable and just world.

This applied research study highlights the pedagogical advantages of promoting sustainability education among master students. By integrating sustainability education

into university curricula, students can develop green skills, foster critical thinking, engage in interdisciplinary collaboration, and cultivate a broader human formation. These pedagogical approaches are crucial for preparing future leaders and professionals who can effectively address sustainability challenges and contribute to a more sustainable and equitable world. Universities must recognise the importance of sustainability education and incorporate it into their master's programs to ensure that graduates have the knowledge, skills, and values necessary to create a sustainable future.

The article aims to underscore the importance of green skills training through a humanistic approach. The Green Skills Lab, integrated into the curriculum for master's students with a focus on behaviours and values associated with green skills, seeks to foster critical thinking and reflection. Pedagogical reflection moves on the level of reflection on the method and process of teaching. Implementing subjects dedicated to green skills, in the optics of the Humanist Approach (Caggiano & Ragusa, 2023), urges a model to be presented and implemented for various institutions, including technical and specialised studies.

2. Green Skills and University Education

University education is fundamental to developing Green Skills, providing students with the knowledge and skills necessary to address environmental challenges and promote sustainability (Ichsan et al., 2019). Numerous studies have highlighted the importance of integrating environmental issues into academic curricula to prepare students to tackle the challenges of ecological transition.

For example, a study conducted by Yea and al. (2017) analysed the inclusion of green skills in the study programs of six universities in Canada. The results showed that universities were increasingly integrating environmental issues into their curricula, offering specific courses on Green Skills, and promoting experiential learning through sustainability-related projects and internships. Another interesting case is that of Utrecht University in the Netherlands, which has developed a bachelor's program in Sustainability and Innovation[2]. This multidisciplinary course aims to provide students with a solid knowledge base on environmental issues and develop the necessary skills to tackle complex sustainability-related problems. Furthermore, Lund University in Sweden has introduced a bachelor's program in Environmental Studies that focuses on developing interdisciplinary skills to address environmental challenges. The program offers courses covering sustainable energy, natural resource management, and sustainable urban planning[3]. Furthermore, master's programs should encourage critical thinking and problem-solving skills to enable students to analyse complex environmental issues and develop innovative solutions (Evans, 2019). This can be achieved through case studies, group discussions, and project-based

2 It is more prevalent for studies concerning Northern Europe. In recent years, Italian and Spanish studies pertaining to the Mediterranean area have focused mainly on empirical studies to assess the impacts of sustainability training programs. Authors such as Lopez Ana Garcia, Del Gobbo, and Sanchez Bernal have contributed to this body of research.

3 Research in the field of environmental sustainability in the last ten years has primarily focused on the environmental impact of architecture, mainly in the area of northern countries. Several studies including Larsson Heidenblad, D. (2021). *The environmental turn in postwar Sweden: A new history of knowledge* (p. 251). Lund University Press, have contributed to this body of research.

learning, where students are challenged to apply their knowledge and collaborate with peers from different disciplines.

Towards sustainable development requires what has been referred to as a sustainability mindset (De Vries et al., 2018), a change of mindset that encompasses core values, attitudes and behaviours, a life system approach that transcends technical learning and is focused upon a more holistic explanation of the broader ecosystem and sustainability (Del Gobbo, 2021). Developing a sustainability mindset also requires a shift in values and attitudes towards the environment. Students should be encouraged to develop a sense of responsibility, empathy, and stewardship towards the natural world. This can be fostered through engaging with local communities, participating in sustainability initiatives, and promoting environmental awareness and activism (Kassel, Rimanoczy, & Mitchell, 2016). To ensure the effectiveness of sustainability education in master's programs, assessing and evaluating the learning outcomes and impact of such initiatives is essential. This can be done through surveys, interviews, and assessments that measure students' knowledge, skills, and attitudes towards sustainability (Tilbury et al., 2017). Feedback from students and alumni can provide valuable insights into the strengths and weaknesses of the program and inform future improvements.

A recent systematic review (López-Alcarria et al., 2019) realised precisely to provide an overview of the research on the effectiveness of some methodologies considered helpful in building the critical competencies of Green Skills (Unesco, 2018), also highlights the significance of other methods: regular group meetings, feedback, working in cycles, equal distribution of tasks, presence of a closer relationship between teachers and students (Lozano et al., 2017)

Integrating Green Skills and a sustainability mindset in master's programs is crucial in preparing students to address the environmental challenges of the 21st century. Integrating green skills training into the master's program is crucial for preparing professionals who can effectively contribute to the ecological transition. The training equips participants with the necessary competencies to address sustainability challenges in their future careers. It fosters interdisciplinary collaboration, critical thinking, and problem-solving abilities, essential for tackling complex sustainability issues. The training also promotes the development of ethical values, empathy, and a sense of responsibility towards the environment and society.

2.1. Lab Green Skills for Master Students

The Laboratory Green Skills for master students is an innovative educational program designed to develop green skills. The laboratory employs a variety of teaching methodologies to provide students with a comprehensive understanding of sustainability and equip them with the necessary skills to address environmental challenges.

The program incorporates a combination of lectures, workshops, case studies, and hands-on activities to engage students in active learning. Students can apply their theoretical knowledge to real-world situations through practical exercises, group projects, and field visits. The laboratory also emphasises interdisciplinary collaboration, allowing students from different academic backgrounds to work together and learn from each other's perspectives. The program is based on the latest research and best practices in sustainability education, drawing on references such as the United Nations Sustainable Development Goals and academic literature on sustainability. By participating in the Green Skills for Master Students Laboratory, students gain valuable knowledge, skills, and experiences that

prepare them to become influential sustainability leaders in their future careers. The Green Skills for Master Students Laboratory is an innovative educational program combining online and blended learning methodologies to provide master students with a comprehensive understanding of sustainability and develop their green skills.

The program is designed to be flexible and accessible, allowing students to engage in the activities at their own pace and convenience.

The online component of the program consists of interactive modules that cover various topics related to sustainability. These modules include multimedia content, such as videos, infographics, and interactive quizzes, to enhance students' learning experience. The online platform also provides a space for students to engage in discussions, collaborate on projects, and access additional resources. This online component allows students to learn at their own pace and allows them to fit their studies into their busy schedules. In addition to the online modules, the program also includes blended learning activities that combine online and face-to-face interactions. These activities provide students with hands-on experiences and opportunities to apply their knowledge in real-world settings. For example, students may participate in field visits to sustainable businesses or organisations, observing sustainable practices in action and engaging in discussions with industry professionals. These field visits provide students with valuable insights into the practical application of sustainability principles and allow them to connect theory with real-world examples.

The program also incorporates workshops and group projects, where students work collaboratively to solve sustainability challenges. These activities encourage students to think critically, analyse complex problems, and develop innovative solutions. Through these collaborative projects, students learn to work effectively in teams, communicate their ideas, and negotiate different perspectives. This approach fosters their ability to address sustainability challenges in a multidisciplinary and collaborative manner.

Furthermore, the program emphasises integrating sustainability principles across different academic disciplines. Students from various backgrounds, such as science, engineering, social sciences, and humanities, are encouraged to share their knowledge and perspectives, fostering interdisciplinary collaboration. This interdisciplinary approach allows students to understand sustainability holistically and develop broader skills and perspectives. Throughout the program, students receive guidance and feedback from experienced instructors who are experts in the field of sustainability. These instructors provide mentorship and support, helping students to deepen their understanding of sustainability concepts and develop their green skills. The Green Skills for Master Students Laboratory provides a dynamic and engaging learning experience that combines online modules, blended learning activities, and interdisciplinary collaboration. By participating in this program, master students gain the knowledge, skills and experiences necessary to become influential sustainability leaders in their future careers.

3. An Applied Research on Green Skills for Master Students

This study investigates the Green Skills of master's students and their readiness to address environmental challenges and contribute to the ecological transition. By examining the green skills of master's students, this research seeks to shed light on the Effectiveness of higher education in fostering sustainability competencies and identifying areas for improvement. The study will utilise a mixed-methods approach, combining surveys,

interviews, and assessments to gather comprehensive data on the students' Green Skills and their perceptions of sustainability education.

Methodology. The research will involve 200 master's students from various curriculums selected through a random sampling technique. The participants will be asked to complete a survey that assesses their knowledge, skills, and attitudes related to sustainability. The survey will be based on established frameworks such as the GreenComp (The European Framework for Sustainability Competences). It will cover environmental science, policy, ethics, systems thinking, and problem-solving. Additionally, a subset of participants will be selected for in-depth interviews to gain deeper insights into their sustainability education experiences and Green Skills development. The interviews will be semi-structured and explore topics such as the effectiveness of sustainability courses, the integration of sustainability into their discipline, and their perceptions of the importance of Green Skills in their future careers. The qualitative data from the interviews will be transcribed and analysed using thematic analysis to identify recurring themes and patterns related to the student's experiences with sustainability education and the development of Green Skills[4]. This quantitative research used A structured questionnaire as a data collection tool. The questionnaire was developed based on previous studies that examined green skills and their implications for higher education (Meyer & Norman, 2020; Kieu & Singer, 2020). The questionnaire was divided into several sections to assess the participants' knowledge, skills, and attitudes related to sustainability. Multiple-choice questions covering various environmental and sustainability topics were included to assess knowledge.

Skills were evaluated through questions that required participants to apply their theoretical knowledge to real-life situations and propose innovative solutions to promote sustainability. Attitudes were assessed through Likert-scale questions that measured participants' level of agreement with sustainability-related statements. The questionnaire was proposed to both groups of students who attended the Green Skills Laboratory. The control group did not participate in the Laboratory. The data were analysed using the statistical software SPSS to conduct descriptive analyses and Student t-tests to compare the mean scores between the two groups. Using a questionnaire as a research tool was motivated by its ability to efficiently collect quantitative data and objectively measure participants' knowledge, skills, and attitudes. The questionnaire allowed for a direct comparison of results between the group of students who attended the Green Skills Laboratory and the control group who did not attend the Green Skills Laboratory, enabling the evaluation of the effectiveness of the Laboratory in improving participants' green skills. The findings from both the quantitative and qualitative analyses will be triangulated to provide a comprehensive understanding of the students' Green Skills and their perceptions of sustainability education.

Sample. The sample for this study consisted of 200 Master's students. The participants were selected using purposive sampling from students who had completed at least one semester of their Master's program. The sociodemographic characteristics of the sample provide valuable insights into the composition of the participants in the study. Regarding the demographic characteristics of the participants, the sample consisted of 90 males (60%)

4 The qualitative interviews revealed a better understanding of sustainability concepts, such as climate change, resource management, and biodiversity. They also developed critical thinking and problem-solving skills and a greater sense of responsibility towards the environment and society. The quantitative analysis confirms these findings, showing a significant improvement in the participants' knowledge, skills, and attitudes related to sustainability after the training.

and 60 females (40%). The sample includes a diverse range of age groups, with the majority falling between 23-26 years old (42%), 29-35 (28%), 26-29 (18%), and over 35 (5%); regard gender 65% women. The data suggests that the study captured a significant portion of the younger population, which is essential for understanding the perspectives and attitudes of the next generation towards sustainability. The sample shows a relatively balanced representation of males and females, with a slightly higher percentage of males. The sample includes participants from various academic backgrounds, with a higher percentage from science and engineering disciplines. The percentage indicates that the study aimed to include participants from different fields, which is crucial for understanding how sustainability is perceived and integrated across various academic disciplines.

Results[5]. The results of this research indicate that the group of students who attended the Green Skills Laboratory reported a significant difference compared to those who did not participate in the Laboratory. The participants in the laboratory demonstrated a higher level of knowledge, skills, and attitudes related to sustainability than the control group. Statistical analyses were conducted using the student's t-test to compare the mean scores obtained by the participants in the laboratory and the control group to assess the difference between the two groups. The results showed that the participants in the Laboratory obtained significantly higher scores than the control group in all evaluated dimensions ($p < 0.05$).

|Dimension	**Lab. G.S**	|Control Group	p-value
|Knowledge	8.2	6.5	<0.001
|Skills	7.9	6.2	<0.001
Attitudes	8.5	6.8	|<0.001

Figure1. Comparison of mean scores between Laboratory G.S and control group.

In particular, the participants in the Laboratory showed a greater understanding of critical concepts related to the environment and sustainability, such as climate change, natural resource management, and the importance of biodiversity. They also demonstrated a greater awareness of environmental issues and social and economic implications. From a skills perspective, the participants in the Laboratory demonstrated a more remarkable ability to analyse and problem-solve environmental challenges. They were able to apply their theoretical knowledge to real-life situations and develop innovative solutions to promote sustainability. Additionally, they showed a more remarkable ability to work in teams and collaborate with individuals from different disciplines to address the complex challenges related to sustainability. The attitudes of the participants in the Laboratory were also positively influenced. They developed a greater awareness of sustainability and individual responsibility in promoting a sustainable future. They demonstrated increased motivation and commitment to contribute to the ecological transition and promote sustainability in their future careers. These results suggest that integrating a Green Skills Laboratory can be a practical approach to developing the skills and attitudes necessary to address environmental challenges. However, further research is needed to confirm these

5 The study employs a mixed-methods approach, combining qualitative interviews with program participants and quantitative analysis of pre- and post-training assessments. The qualitative interviews provide insights into the participants' experiences, perceptions, and attitudes towards green skills training.

findings and explore the long-term impact of the Green Skills Laboratory on participants' careers and commitment to promoting sustainability.

4. Conclusion

The findings of this study will add to the current literature on sustainability education and the development of Green Skills in higher education. By investigating the Green Skills of master's students, this research will offer insights into the effectiveness of ongoing sustainability initiatives and pinpoint areas for enhancement. These results will guide curriculum development, teaching methods, and institutional policies to better equip students with the necessary competencies to tackle environmental challenges. Moreover, the study will underscore the significance of interdisciplinary collaboration and the integration of sustainability across various disciplines. The implications of this research go beyond academia, as the cultivation of Green Skills is essential for individuals to contribute to the ecological transition and advocate for sustainability in their future professions.

The study underscores the importance of integrating sustainability education and green skills training into master's programs to prepare upcoming professionals who can effectively support the ecological transition. The outcomes of this study demonstrate the benefits of incorporating green skills training into master's programs. Participants in the training program reported a substantial enhancement in their knowledge, skills, and attitudes related to sustainability. They better understood critical concepts such as climate change, resource management, and biodiversity. These results provide proof of the positive impact of green skills training on master's students. By offering students a comprehensive comprehension of sustainability and arming them with the necessary skills, master's programs can play a crucial role in preparing professionals capable of addressing sustainability challenges. Integrating green skills training fosters critical thinking, problem-solving abilities, and interdisciplinary collaboration among students. It also encourages the development of ethical values, empathy, and a sense of responsibility towards the environment and society.

Integrating sustainability education and green skills training into master's programs is crucial for preparing future professionals to support the ecological transition effectively. The study's outcomes demonstrate the advantages of incorporating green skills training into master's programs, with participants reporting substantial improvements in knowledge, skills, and attitudes related to sustainability. This indicates the positive impact of green skills training on master's students, enhancing their understanding of critical concepts like climate change, resource management, and biodiversity. By equipping students with comprehensive sustainability knowledge and skills, master's programs play a vital role in preparing professionals to address sustainability challenges. Integrating green skills training into master's programs aligns with the call for education and training for the ecological transition and developing competencies and professionals for sustainability. It addresses the demand for professionals who can effectively contribute to the transition towards a more sustainable and resilient society.

Further research and collaboration among academia, industry, and policymakers are necessary to ensure the widespread integration of green skills training into master's programs and to support the development of competencies and professionals for sustainability who can effectively contribute to the ecological transition. The findings of this study contribute to the growing body of literature on sustainability education and the

development of Green Skills in higher education. By examining the Green Skills of master's students, this research provides valuable insights into the effectiveness of current sustainability initiatives and identifies areas for improvement. These results significantly impact curriculum development, pedagogical approaches, and institutional policies to prepare students better to address environmental challenges. Furthermore, the study underscores the importance of interdisciplinary collaboration and the integration of sustainability across various disciplines. The implications of this research reach beyond academia, emphasising the essential role of Green Skills in fostering individuals' ability to contribute to the ecological transition and promote sustainability in their future careers.

Pedagogically, this study underscores the importance of incorporating experiential learning, case studies, and real-world projects into sustainability education and green skills training. These active learning methods can enhance students' engagement, critical thinking skills, and practical application of sustainability concepts. Promoting collaborative learning environments and fostering interdisciplinary discussions can help students develop a holistic understanding of sustainability challenges and solutions. By emphasising hands-on learning experiences and encouraging collaboration, educators can better prepare students to address complex environmental issues and contribute meaningfully to sustainability efforts in their future careers.

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