Education of sustainable development goals through students' active engagement: A transformative learning experience

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Abstract

Purpose The concept of Sustainable Development (SD) is tightly bound with education. Education for SD is becoming increasingly important since the introduction of the 17 Sustainable Development Goals (SDGs). Due to the essential features of SDGs' interlinkages and targets, new teaching techniques are needed.

Methodology With the use of a single revelatory case study, this paper presents an example of Education for Sustainable Development Goals activity carried out at the University of Torino focused on merging SD with the active engagement of students.

Findings The empowerment of students happens through a transformative learning experience grounded in the acquisition of managerial soft-skills useful in co-creating and co-designing projects to contribute towards SDGs effectively.

Originality The paper showcases how transformative learning could be applied to SDGs. Awarded as one of the best practices regarding SD by the Italian Network of Universities for Sustainable Development, the case involves students in a transdisciplinary, creative and open learning environment.

Social implications Students learnt about SDGs and the complexities of sustainability, and, at the same time, they learnt valuable tools to contribute to their transformation to develop projects for the benefit of local territories and organizations. The ultimate goal is to support them to become active citizens in their communities (e.g. starting within the University).

I. Introduction

> *By regarding education as an end in itself, we recognize*
> *knowledge to be one of the ultimate values.*
> Abul Kalam Azad, Minister of Education of India (1947-1958)

The concept of Sustainable Development (SD) is tightly bound with education: training and education in SD, and achieving a sustainable future, are two mutually reinforcing concepts. According to UNESCO (2017, p.1), Education for Sustainable Development is a "holistic and transformational education that addresses learning content and outcomes, pedagogy and the learning environment". It does not only integrate contents from different disciplines, but it also creates interactive and learner-centred teaching. Moreover, with the release of the 17 Sustainable Development Goals (SDGs, Resolution 2015), the role of education has been strengthened even further. SDG number 4 is about education, and its target 4.7 is designed explicitly to promote Education for Sustainable Development (target 4.7).

Consequently, education is intended as a public good where teachers, students, public and private sectors, as well as civil society and universities, are all called to realize the right to quality education for all (UNESCO, 2015). Universities, especially the public ones, are invited to become leaders in educating for SDGs and in accounting for the results achieved (UNESCO, 2017). One of the critical features of the United Nations' Agenda 2030 for Sustainable Development is to promote both specific and transversal skills in learners of all age groups through cognitive and non-cognitive pedagogies (Rieckmann et al., 2017). Also, the socio-emotional dimension should be considered as it helps learners in going beyond the knowledge and the thinking phase to acquire competencies useful in collaboration, negotiation and communication with stakeholders (UNESCO, 2017).

Education for SDGs should avoid a formal teaching style and aim for a more transformative learning approach to encourage tomorrow's leaders to be committed to developing a sustainable behaviour in their relationships, inside every organization, at institutional and public-management level (Rieckmann et al., 2017). As its structure is elaborated in targets and indicators that cover multiple areas, its learning requires a complex background of applied knowledge, as well as, of transversal abilities. By derivation, universities all over the world are called on by UNESCO to develop cases to be replicated on how strategies, policies and programmes have been set up to match Education for SDGs (Rieckmann et al., 2017).

Generalist public universities cover all the fields of knowledge (also called Humboldtian universities), and they might play a pivotal role for sustainable development (Adams et al., 2011). Impressive compartmentalization continues to influence the concept of Education for SD (Ramos et al., 2015) mainly due to a lack of strategic, systemic thinking in involving all the parties of a university system towards a sustainable development. Traditional teaching models can be helpful in identifying the SDGs, while more sophisticated teaching techniques are needed to develop students' awareness and engagement in entering into the merit of each goal and indicator. Also, to become successful in promoting the proper mind-set to be applied in dealing with such wicked problems (Rittel and Webber, 1973), a transformative process based on the acquisition of different soft-skills is necessary (Iyer-Raniga and Andamon, 2016; Pritchard et al., 2018). Consequently, universities and Higher Education Institutions (HEIs) might think about the opportunities for setting up transformational Education for SDGs learning programmes through their traditional teaching offers.

The ability to embrace risk, to understand ambiguity, to be committed, to develop critical thinking and to appraise the sense of leadership are all fundamental steps of a transformative learning path (Bendell et al., 2017; Sunley and Leigh, 2017). Nonetheless, the risk that the commitment of students falls away after completing their courses or projects is high. This paper supports an active engagement perspective to Education for SDGs, answering the call of scholars to determine a shift from traditional teaching to transformative learning, and tests the validity of innovative pedagogies (Correa and Larrinaga, 2015; Lozano et al., 2017; Molderez and Fonseca, 2018; Scheyvens et al., 2016). A creative and open learning environment can enhance students' soft-skills used to disentangle the complexity behind the interconnections between businesses, societies and environment creating long-lasting commitment (Slahova et al., 2007).

Considering that UNESCO promotes transformative pedagogies oriented to realize actions in the context of local communities and the ordinary life of learners (Rieckmann et al., 2017), this paper describes and critically evaluates a revelatory case study of an extra-curricular Education for SDGs activity carried out in one of the largest Italian universities. As transformative learning becomes effective only if applied, the case study shows an example of how teams of interdisciplinary students elaborated business projects to contribute to tackling SDGs through the acquisition of knowledge and managerial soft-skills. Managerial skills are needed to deal with uncertainty and ambiguity (Parente et al., 2012). They can be identified as technical abilities useful to strategize, to plan, to organize and to control (Robbins and Hunsaker, 2000). Participation, personal commitment and dedication have been matched to managerial tools to co-design and to co-create projects and plans that can be applied by universities, in a sort of circular value creation cycle.

Imagination and heroism towards SDGs are a spillover effect to be developed by those who are attracted by the idea of becoming active sustainability leaders (Efthimiou, 2017). The aim of this

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paper is to discuss the empowerment of students (Lozano, 2006; O'Dwyer, 2005; Papineau and Kiely, 1996; Späth and Scolobig, 2017), following the acquisition of managerial soft-skills that are boosted through the ability to apply them to specific problems and issues created by an understanding of the SDGs. As Education for SD is transformative and active by nature, the development of an effective strategy towards Education for SDGs needs to be further investigated.

To set up entire courses or modules focused on Education for SDGs might be difficult and costly especially for generalist and large universities that usually provides problem-based or project-based pedagogies around a single SDG or a selection of them. Nevertheless, , Education for SDGs should be radical and transformative. This transformation aims at developing in learners a sentiment of leadership (Adams et al., 2011). Studies on Education for SDGs lack focus on transdisciplinarity and inter-disciplinarity that are the core of transformative learning (Lozano et al., 2017). In transformative learning, the learners are also pushed to analyse their context, and consequently, universities are called to become places where learners can test their knowledge and create new knowledge, as is the case with living labs.

This paper showcases an extra-curricular activity coordinated by the central sustainability office of the University of Torino, about leadership for SDGs. The novelty of the workshop relies on the application of managerial skills to create innovations through the development of business projects. The business projects are, in turn, likely to be implemented by university managers, generating a circularity. Awarded as one of the best practices regarding SD by the Italian Network of Universities for Sustainable Development and selected as best practice from the International Sustainable Campus Network for the World Economic Forum 2018, the workshop is analysed to investigate the element of transformative learning and the power of managerial skills to improve the leadership for SDGs. The research questions addressed in this paper are:

- *Due to the specificities of SDGs, what are the elements of transformative learning that need to be considered in developing a training experience on leadership for SDGs?*
- *Which are the managerial skills useful to give concreteness to Education for SDGs?*

The following section provides a *Literature review* examining the interlinkage framework among Education for SD and transformative learning processes. In the second part of the literature, the paper reviews the role of inter and transdisciplinarity as a way to go further the learning-by-doing methods entering in the merit of managerial decisions and actions for SDGs. The *Methodology* section illustrates the case study method, providing an overview of the design of the Education for SDGs workshop. Finally, the *Discussion* section presents a qualitative analysis, ex-ante and ex-post, on participants' knowledge, critical thinking, envisioning and business development skills. The *Conclusion* gives suggestions for replicating the study, emphasizing the relationships between disciplines in ESDGs and for future development of this educational field.

II. Literature review

Education for Sustainable Development Goals (ESDGs)

While the literature on universities and Education for SD is vast and extensive (Karatzoglou, 2013), studies on Education for SDGs are still rare (Lozano et al., 2017; Sinakou et al., 2017). This paper is based on the notion of SD presented in the 1987 Brundtland report (WCED, 1987), and on the

Education for SD that has evolved and extended worldwide during the last fifteen years thanks to the policies adopted by the United Nations and UNESCO. In 2005, the Decade of Education for Sustainable Development was established with the purpose of promoting awareness about SD (Cars and West, 2015; UNESCO, 2004; Van Wynsberghe and Moore, 2015). Moreover, since 2014, UNESCO has coordinated UN agencies, programmes and organizations on integrating principles, values and practices of SD in teaching (Leal Filho et al., 2015; Mintz and Tal, 2016). It has also delivered strategies to shape countries' policies on education and learning at all levels from primary education to adult training.

Additionally, on 25 September 2015, the United Nations approved the Global Agenda 2030 for Sustainable Development and its 17 SDGs, an evolution of the previous Millennium Development Goals (MDGs), underscoring the role of Education for SD again. These 17 goals are elaborated in 169 targets and more than 240 indicators. This structure embraces the triple-bottom line (Elkington, 1997), an agenda for corporations that focuses not just on the economic values that corporations add, but also on the environmental and social benefits they produce or destroy including human rights, education and gender equality. In the SDGs, precise and technical notions constituting the general framework are interlinked with the different socio-cultural and socio-political factors of each country (Weitz et al., 2014, 2017). The SDGs shape a fully interconnected network, where each goal is related to others through a cause-effect relation as demonstrated by the interconnectivity of targets and indicators (Le Blanc, 2017). For their achievement, a more holistic approach is required (Coopman et al., 2016), where multi and interdisciplinary collaborations are needed to fully disentangle the link between one indicator and another (Griggs et al., 2013; Nilsson et al., 2016).

Consequently, SDGs are broader in scope and involve all stakeholders at all levels, including in the specific universities and HEIs that are responsible for Education for SDGs in adult education (Nilsson, 2017). At present, studies on Education for SDGs recognize three levels of action, teaching (Wu and Shen, 2016), research (Karatzoglou, 2013) and sustainable management of the university (Verhulst and Lambrechts, 2015). Studies integrating all three of these dimensions systemically are still rare (Mader et al., 2013; Pritchard et al., 2018). For instance, the work of Disterheft et al. (2015) documents a sample of participatory projects to develop sustainability in higher education, but these projects are far from being labelled as pedagogies because they have been developed as campus sustainability initiatives.

Experiments about Leadership for SDGs have been described in the 2017 report by Sustainable Development Solution Network. The guide cites three similar workshops carried out by three different Australian universities (SDSN, 2017). What remains unclear is the pedagogy and the methodology adopted in these three similar initiatives to demonstrate their validity regarding transformational learning. Although the report mentions the positive outcomes of the experiment, there is a generalised lack of studies on transformational learning for SDGs, its principles and dynamics. More in-depth knowledge of the dynamics of transformative learning is needed to assure the comparability of different pedagogies of Education for SDGs.

Transformative learning
Talking about transformative learning pedagogies is even more difficult because the transformative process in adult education happens when "learning is for being" (Mezirow, 2000), or in other words when learning is for shaping more sustainability-oriented individuals (Wals, 2010). To be successful, educators should facilitate the transformative learning experience (Cebrián et al., 2013;

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Iyer-Raniga and Andamon, 2016; Venkataraman, 2009), and as well, universities should be committed to changing public managers' competences, in experimenting with new pedagogical approaches and in leading the entire institution towards SD (Lozano et al., 2016).

The learning of SDGs requires some necessary competences such as *systemic thinking*, to understand the complexity behind sustainability and the interconnections among environmental, economic and social systems; *envisioning*, to imagine a "better" future; *partnership building*, to promote participation in the decision-making processes; *critical thinking*, to question and criticize the status-quo (Tilbury and Wortman, 2004). In addition to these competences, UNESCO (2017) clarifies that other competences are also required. *Normative competences,* to understand norms and values that root individuals creating potential conflicts and competing logics; *strategic thinking,* to develop innovative actions; *self-awareness* to reflect on the role of everyone in their local community; and, *integrated problem-solving* to apply and to propose workable solutions to the complex problems addressed by SDGs.

It appears evident that Education for SDGs may be difficult to teach in traditional instructional formats. Active and open learning seems to be more suitable to engage students throughout their entire career (Braßler, 2016; Braßler and Block, 2017) because transformational learning is enhanced by continuous competences (Abou-Warda, 2014; Sipos et al., 2008; Taylor and Cranton, 2012). There is a lack of studies on how to match the essential elements of a transformative learning experience to Education for SDGs. In particular, Education for SDGs should consider features such as interdisciplinarity and transdisciplinarity to integrate sustainability perspectives in problem-solving (Figueiró and Raufflet, 2015); to stimulate the engagement of students as a fundamental part of the transformation (Disterheft et al., 2015); offering continuous competences such as managerial soft-skills to be used to apply SDGs in the real context (Abou-Warda, 2014).

Inter- and Transdisciplinarity
This paper does not enter into the merit of the compartmentalization issue that affects universities (Ingallina and Charles, 2018), even though it should be considered that generalist universities might face multiple problems in addressing ESDGs because their professors cover various disciplines, sometimes in competition (e.g. sustainable use of resources vs. atomic energy). Implementing SDGs in the curricula requires pedagogical adjustments (Spangenberg, 2017). Due to the integrated, indivisible and interlinked nature of the SDGs, Education for SDGs must involve several perspectives. UNESCO affirms directly that "no one discipline can claim education for sustainable development for its own" (UNESCO Education, 2005). According to Clark and Wallace (2015), there are four options: disciplinary, multi-disciplinary (Adams, 2010), interdisciplinary and transdisciplinary approaches (Gough and Longhurst, 2018; Pritchard et al., 2018).

Several studies focus on interdisciplinarity in the sense that disciplines are fully integrated into the training (Annan-Diab and Molinari, 2017; Braßler and Block, 2017; Howlett et al., 2016). Only a few studies support the transdisciplinary approach where there are no clear boundaries between disciplines, and the university becomes a platform where transformative learning occurs (Adomssent et al., 2007; Anderberg et al., 2009; Mauser et al., 2013). Multi-disciplinary

pedagogies are not favoured as documented recently, because they tend to create a less integrated approach to sustainability (Figueiró and Raufflet, 2015)[1].

Following Kysilka (1998), interdisciplinarity occurs where students become active decision-makers instead of simple receivers of knowledge, and teachers act in a collaborative way instead of working in isolation. Several options are available for universities, but scholars agree on the need for systems thinking and interdisciplinary approaches (Pappas, 2012). Adopting a systemic approach requires changes in higher education courses, additional training and vocational activities, or postgraduate courses (Jain et al., 2013; Vermeulen et al., 2014). These available options imply several degrees of complexity and costs, primarily from public universities, where teaching, research and societal outreach are closely linked (Leydesdorff, 2012).

A study by Lozano et al. (2017) summarizes ten years of reviews on ESD, producing a match between skills and competences on sustainability and pedagogical approaches. The study identified Project and Problem-Based Learning (PPBL) as the most effective educational approach to teach useful competences for educating for SD. Hypothetically, PPBL should also be adopted in Education for SDGs. However, the study of Lehmann et al. (2008) on PPBL affirms how important it is to move from the problem side called "know-how" to give more emphasis to "know who", "know what" and "know why". Consequently, the risk of a narrow view of a problem can be overcome using an innovative learning environment such as those that use universities as a lab for experimenting with sustainability projects.

Active engagement, interactivity and co-creation
The social contract between universities and their communities is grounded on the stewardship role that such institutions might play for the prosperity of their territories (Cortese, 2003). The activities of universities extend beyond teaching and research activities: public engagement and, in particular, the active participation of students could be beneficial when targeted on projects of co-creation and co-development. For students being engaged in co-creation processes gives concreteness to their values and their academic career (Antal, 2013). The commitment to SDGs can be emphasized by using universities as an innovative learning environment (Benavot, 2017).

In the late 1990s and early 2000s, Living Labs began to be adopted as a new approach for engaging citizens and stakeholders within innovation processes and research projects. The original aim of Living Labs was to test innovative technologies in home-like environments and not in laboratories or other controlled environments (Markopoulos and Rauterberg, 2000). Within a few years, the Living Lab approach has spread worldwide and, nowadays, it is often adopted to design and test applied research projects in a real-world context by supporting open and co-created innovation (Leminen et al., 2012; Nystrom and Leminen, 2011). This paper adopts the view of Living Labs as loci, i.e. creative social spaces where users are involved in the process of co-designing and testing innovative technologies to shape their future. As Education for SDGs trains the participants to become stewards of a sustainable future, Living Labs would seem to be appropriate learning methods to be honed and applied.

Living Labs aim to create a collaborative design environment for open innovation among private companies, public organizations and private citizens to deal with a specific innovative issue

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[1]   It should be noted that the work of Figueirò and Raufflet (2015) is also about management education and not about education in general.

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(Chesbrough, 2003). Living Labs can vary depending on organizational aims, the level of user engagement and the degree of openness (Tang and Hamalainen, 2012). This paper considers universities as appropriate settings for housing Living Labs presenting the case of a public university in Northern Italy that set up an extra-curricular workshop on Education for SDGs. The study starts from a pedagogical approach (organizational level) to present its results regarding the individual level that can impact, in turn, both the organizational and systemic levels through the development of projects, in a circular way.

Managerial skills to be used to apply SDGs in a real context
Until now, the paper has been focused on the importance of setting up new pedagogies oriented to foster in learners a transformation, and primarily to understand and emotionally elaborate SDGs. The paper has also highlighted the opportunity for the learners coming from interdisciplinary collaborations, and from the application of theoretical knowledge to practice (transdisciplinarity). The paper addresses now another improvement in the process of transformation that seems to be ignored by scholars, that is the so-called managerial skills. Managerial skills such as those used by managers to develop strategy, to organize, to plan and to control might be useful in transformational learning to prompt learners to create actions in their local communities (Parente et al., 2012). These skills appear to be a necessary facilitating mechanism for further management development (Parente et al., 2012).

As co-creation and co-development require learners to cooperate with other stakeholders, the way in which learners can interact with non-academic experts in working towards SDGs is entirely unexplored in the literature. To investigate if the learning of managerial skills is boosted through the ability to apply them to specific problems and cases, students might first understand the SDGs and progressively, acquire skills to propose practical solutions, business ideas, new projects that should be sustainable, feasible, and scalable. Although the development of projects seems to be the natural evolution of the transformative learning of SDGs, its dynamics, objectives and functioning mechanisms are entirely absent in the literature.

For instance, a transdisciplinary approach becomes central in the way it fosters collaboration between entrepreneurs, managers and experts in working with the learner to realize a project (Godemann, 2006, 2008). As learners in public and generalist universities come from different fields of knowledge, the development of a transformative learning activity should consider different mind-sets. In particular, the literature does not offer any support in showing cases of generalist universities, SDGs and transformation. For example, how can a student of philosophy arrive at developing a business plan to contribute towards solving a specific SDG and propose a sustainable project?
To address these multiple issues, this paper presents a pilot project with all its successes and deficiencies in the form of a workshop aimed at creating successful leaders in achieving the SDGs.

III. Methodology

This research methodology relies on the analysis of one revelatory case study from an intrinsic perspective (Baxter and Jack, 2008; Stake, 1995; Yazan, 2015). Case study method allows producing comprehensive and significant evidence concerning the studied topic (Yin, 1994). Intrinsic case studies are based on the intrinsic interest of researchers in the subject, as such

researchers are immersed in helping to solve problems associated with the phenomenon under investigation, but also they need to be critical in their observations and interventions as they construct the data of the research project (Dumay and Baard, 2017; Dumay, 2010). Exploratory in its nature, the paper showcases the importance of transformative learning in building connectivity, changing perspectives and understanding the mutual reinforcement of SDGs.

Data were collected through a participatory action process, and researchers took an active part in the project by participating in every step of the workshop, from its design to its end by collecting feedbacks after six months. Qualitative analysis of the feelings, emotions, expectations, reactions were used in the data analysis (Eriksson and Kovalainen, 2015; Hsieh and Shannon, 2005). This direct involvement guided the researchers to remember the students involved, their background and commitment during the activities in the case. Participants signed an informed and privacy consent before being involved in the project, according to the ethical guideline of the University of Torino. Exploratory in its nature, the paper showcases the importance of transformative learning in building connectivity, changing perspectives and understanding the mutual reinforcement of SDGs.

The validity of this work is achieved through the triangulation of data that was performed by connecting different kinds of data bearing on the same phenomenon (Jick, 1979). Data were combined from primary sources and secondary sources. Primary sources are multimedia sources, such as recorded videos, photos, and questionnaires that were double-checked by researchers to avoid any misinterpretation of results. Secondary data sources are business plans, minutes, notes of events, diagrams and posters. Collaborative research meetings of all the research group members have been set up to avoid any risk of misinterpretation of data. The analysis of the data, especially the ones reporting sentiments, feelings and opinions has been performed according to the principles of sentiment analysis and subjectivity (Liu, 2015). Therefore, a narrative discussion is provided to enrich and bring valuable insights for those interested in replicating this work or starting to work with the concept of Education for SDGs. Consequently, the hermeneutical units of this paper are summarized in Table 1 and are reported in chronological order.

[INSERT TABLE 1 HERE]

IV. The workshop

"Education for Sustainable Development Leadership Training" was conceived as a 2-day workshop (16 hours total) made of modular blocks to allow for replicability and scalability. Each block consisted of 1-2 hours of active learning coordinated by a facilitator, one for each block, with a background relevant to the topic. Facilitators were lecturers, researchers, practitioners and experts, with experience in active learning and engagement, to avoid the use of dogmatic teaching and to promote inter- and transdisciplinarity (Sunley and Leigh, 2017).

General Framework and Partners
The workshop was held at the University of Torino (Italy) in April 2017. University of Torino was founded in 1404 and nowadays involves more than 78,000 people daily. With 27 Departments, it provides a whole range of courses in all disciplines except for Engineering and Architecture (provided by the local Polytechnic). From 2014, it has undergone a slight, but relevant shift in

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recognizing its social responsibilities and it has started to be involved in sustainability reporting activities and organizational changes creating a whole central department devoted to sustainability issues, an institutional role (Deputy director for sustainability) and a green office. The workshop on SDGs leadership, herein discussed, was promoted at the institutional level to actively engage students in the process of envisioning the future of their university, explicitly following the SDGs.

The workshop aimed to teach basic knowledge of the 17 SDGs and their interlinkages applying transformational learning theory. Multiple stakeholders were engaged in its development. The World Water Assessment Programme of UNESCO, the University of Torino Green Office and the UNESCO Chair in Sustainable Development and Territory Management chaired the presentation of each module. Other stakeholders also took part. Cinedumedia, a multidisciplinary centre on Cinema, Education and New Media, led the communication module, while the business incubator 2i3t and the Italian Accenture Foundation hosted the evaluation pitch. Five experts in sustainability took part as stakeholders in the evaluation pitch (jury) such as professors, managers, researchers, experts. They were actively involved as facilitators respecting the multi-stakeholder framework required by Education for SDGs.

The design of the workshop considering active engagement
The FormIT methodology helped the researchers in designing the active engagement phase (Bergvall-Kareborn and Stahlbrost, 2009; Ståhlbröst and Holst, 2013). According to FormIT, the first step for co-creating is to develop new concepts and stimulate stakeholders and users' engagement. Based on past and present narratives and needs, the participants were encouraged to think about "what has been/ is" (past and present) to "what might be" (future). This approach aims to stimulate the users' imagination and to visualize "possible and better" future scenarios while using today's technologies. In turn, it can shift the users' mentality from negative consequences to positive impacts. The process is iterative and based on user interaction.

FormIT serves to plan a need *for* a service, to move towards a need *in* the service, and finally to generate a need in and for the service. This approach is suitable for transformative learning because it encourages experiential learning through the development of a solution (technical and concrete). For this reason, the match between the FormIT purpose and interventionist research (Dumay and Baard, 2017; Dumay, 2010) is beneficial and supportive to a final goal of creating impact for students and universities.

Participants
The workshop was aimed at bachelor, master and PhD students of all courses and disciplines with an interest in SD. To clarify, students were asked to submit their application indicating their interest in SD, with the aim of attracting people with a fundamental commitment to SD, even though researchers distinguished between interest and knowledge of SD. Interest in SD, for this selection, meant demonstrating a commitment towards participation and volunteerism.

Almost 70 students submitted applications, but only 30 were selected on the basis of three criteria: 1) their student status in order to create a diverse class in terms of degrees (Bachelors, Masters and/or Doctorate); 2) the academic background in terms of specialization (environmental, economics, communications, social and life sciences); 3) their personal interest in sustainable development, which was evaluated by a short assessment questionnaire that they had to fill out during the application process. The majority of participants have a humanities background (30%),

followed by those on environmental science courses (27%) and students of communications science (19%). Management, economics and life sciences were underrepresented.

The questionnaire was focused on the motivations for a student's interest in the topic. Students were asked four questions. The first was about their motivation for joining the workshop; the second was about their attitude to developing projects (*Have you ever developed applied projects, like being a volunteer*?). The third and fourth question focused more on their previous experience in SD, if any, and if they had any business idea linked to sustainability. Thus, students were evaluated to have at least a declared interest in SD. Being interested in SD positively influenced the sample of learners involved, but it does not mean that the candidates were familiar with the SDGs. This choice was made to enable the first test of this pedagogy. Table 2 reports students' answers regarding past experiences and future willingness; it can be noted that most of the wishes of students rely on developing future business activities oriented to sustainability.

[INSERT TABLE 2 HERE]

The structure of the workshop
Each module has been created to be logically linked to the subsequent module (input-output logic). The workshop was composed of two main parts. The first part focused on a fundamental understanding of the SDGs ("What are the SDGs?" module), their targets and interlinkages ("Project Cycle Management" and "Visual Thinking" modules), their complexity in searching for workable solutions ("Visual Thinking" and "Leadership and Public Speaking" modules). Consequently, the second part of the workshop was dedicated to the development of managerial reasoning through the application of management tools to SDGs. Table 3 summarizes the structure of the first part of the workshop.

[INSERT TABLE 3 HERE]

The first part of the workshop ended with a control phase based on the National Education for Sustainability K-12 standard. K-12 was used to check if the transformative learning was successful and to what degree. K-12 identifies three levels of knowledge, starting from an essential learning of sustainability to a complete incremental learning process that ends with the achievement of soft-skills useful for sustainability ("National Education for Sustainability K-12, Student Learning Standards, Version 3", 2009). These levels are: 1) SDG basic knowledge linked to the ability to describe SDGs; 2) SDGs challenge, to understand the complexity among economy, ecology and society; 3) SDGs Solutions, to have internalized the SDGs so the student can provide his or her elaboration on workable solutions to an existing problem related to development.

Although K-12 is applied for the training of students since the twelve grades (correspondent to the end of high school training), researchers decided to use it for the evaluation phase as a mechanism of control. A way to test students' knowledge about SDGs. More precisely, as the students involved in the workshop were interested in SD, without having any technical and scientific understanding of it, K-12 has helped the researchers to reduce the gap between those who had previous experience and who did not have any. It is, therefore, necessary to clarify that the candidacy of the interested students was open to all, including first-year students, who belong to the next step after the K-12.

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Consequently, in this case study, each group almost reached level 2, seven out of nine groups reached level 3, achieving the envisioning of workable solutions for sustainable development related to a precise SDG. To give a concrete example of each level, for level 1 (SDGs Description) a satisfactory answer is represented by the ability of the learners to detach and interpret indicators and metrics. Valid responses were: "*Forests cover 31% of the global surface and 1.6 billion people depend on forests for their survival*" [Female, Master student, Geography about SDG 15] or "*Access to energy is not obvious nowadays. It is estimated that one in five people in the world has no access to electricity*" [Male#3, Master student, Environmental science about SDG 7].

Level 2 is about understanding the complexity implied by SDGs under the triple-bottom line, and most important, to acquire the ability to recognise SDGs and their challenges in the daily routine. Gaining awareness of a problem, in a different context from the academic one, or acquiring the ability to fragment a significant problem in sub-problems, is an upgrade in the level of learning and transformation. For instance, one participant said *"Recently, in a supermarket, I noticed a can of tomato sauce for 16 cents, which needs to cover the tomato production, the manufacture of the tin, as well as the transportation, storage and final distribution. Obviously for 16 cents this process could not be sustainable*" [Male, Master student, Management].

The third level covered by the K-12 model is represented by the provision of personal elaboration of workable solutions to an existing problem related to development. At this stage, students ground their solution on their own background, and they start to think and invent innovative solutions with their imaginary. *"We need to start from the education and to propose a new educational method, such as experiential or outdoor learning, to enable children to be empathetic with the environment and to feel part of the planet"* reported one component of a group in the video about SDG 4.

At the end of this stage, and what is relatively underexplored, is the need for managerial skills which are able to transform ideas and thoughts in feasible, sustainable and scalable projects. ~~Consequently, the second part of the workshop was dedicated to the development of managerial reasoning through the application of management tools to SDGs.~~

In the second part, learners were involved in applying their knowledge through the development of business ideas ("Brainstorming Ideas" module) in which participants worked in teams to define their projects using a Business Model Canvas approach. Later, the teams delivered short presentations during the "Pitch and Presentation" module. According to Checkland (1981) and following the FormIT approach, after these two modules, students can effectively design a solution developing a service that meets a need. Table 4 reports the structure of the second part of the workshop.

[INSERT TABLE 4 HERE]

The output of the second module was based on a design process that applies the knowledge and skills acquired during the first modules. Five participating teams were created to pitch and present business ideas to solve a real-world problem connecting several SDGs. These final projects were evaluated by a jury of five representatives of UniTo's stakeholders with business experience. Five evaluation criteria were established: 1) the originality of the idea, 2) the innovativeness and technological level, 3) the scalability and the replicability, 4) social and environmental impacts and 5) financial sustainability.

The final projects were: *Lovin' Corks***,** a circular economy local supply chain to recycle cork, engaging local producers, suppliers and retailers (SDGs: 13, 12, 15, 17 and 11); *OmiCup***,** a new design for a sustainable water bottle for students (SDGs: 6, 8, 11, 12, 14 and 15); *FreeWaste***,** an

innovative and fast biodigester to produce biofuels and compost to be implemented in UniTo (SDGs: 7, 9, 11, 12, 13, 15 and 17); *MyButtaTo***,** innovative reverse vending machines for aluminium and plastic waste to stimulate recycling through an eco-gamification process (SDGs: 6, 11, 12 and 14); *UniTogether***,** interactive and participatory service maps for foreign students within the City of Torino in order to facilitate integration and social inclusiveness (SDGs: 4, 10 and 11)[2]. The project FreeWaste won the challenge.

V. Findings

Evaluation ex-ante
In line with the work of Vermeulen et al. (2014), the ex-ante survey revealed the main reasons that led students to enrol in the workshop. A few students declared having experience with previous projects related to SD, mostly as volunteers and few were founders of NGOs (3 participants). In general, students claimed to be interested in topics such as sustainable mobility, consumption practices, waste management and reuse (often referred to as "circular economy projects"), urban gardens, agricultural production and reducing inequalities.

On a closer examination of the ex-ante answers, three recurring themes emerge. The first is the need to realize the concrete application of the SDGs and their possible solution. The second theme is the need to acquire more skills for their future working careers linked explicitly to sustainability. The third theme is the need to liberate themselves as a person and a citizen.

The need for concreteness emerges from the following statement: "*the workshop ought to be a wonderful opportunity to learn how to critically analyse ideas apparently working, examining their feasibility*" [Male#1, Master student, Environmental science] or "*I would try to make my ideas more concrete, even by simply putting them on paper and talking to other people*" [Male, Bachelor student, Natural science]. The concrete is also apparent in "*wanting to change things*" [Female, Bachelor student, Cultural anthropology], "*be supportive of change*" [Male, Specialization student, Law], and "*developing useful ideas here, locally*" [Male#2, Master student, Environmental science].

The second theme, that is, improving personal skills is almost always seen in conjunction with the need to assert oneself in the world of work. "*I'm ready for shared leadership, representing students in the University, but I would like to acquire skills on how to mobilize others towards sustainable actions and behaviours*" [Male#3, Master student, Environmental science]. Alternatively, as said by a master student in Environmental economics, "*I have a lot of creativity and resourcefulness, but I need help from more experienced people in project management*" [Female, Master student, Environmental science].

Contrary to the previous quotes that reflect egotism and egoism in students, here is a statement that affirms a sort of generous personal commitment in SD. *"In my small way, I'm trying to be a good example to the people around me"* [Male, Master student, Management], or *"I expect the workshop to develop a profound personal awareness of everyday behaviour and the way they influence the sustainability of the entire system"* [Female, Bachelor student, Communication science].

Evaluation ex-post

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[2]   All presentations and photos are publicly available at: http://www.green.unito.it/it/node/316

The ex-post survey was conducted to understand the outcome of the workshop and identify any improvement in the participants' knowledge and skills, and the students' ability to engage in practical activities towards the SDGs following the workshop. The researchers asked them if the workshop and the innovative pedagogies employed had succeeded in improving their knowledge of the SDGs. The answers revealed an improvement in learners' soft-skills, but also a need for more practical training in project development. It should be noted that many students recognized the shortcomings of the traditional curricula in teaching SD and they pointed out that the soft-skills acquired would be relevant to their professional interests. Almost all the respondents declared that they considerably improved their competences on Stakeholder Governance, Leadership and Public Speaking skills. At the same time, they stated a quite satisfactory improvement in SD, Design Thinking and Business Modelling. More should be added to the workshop on the normative specificities of each SDG as the different backgrounds of the students required them to be engaged in long debate around the meaning of specific words.

The inter- and transdisciplinary approach was rated as one of the successful parts of the training by 75% of respondents. "*It was useful to have different points of view, but it's not easy dealing with someone who has a completely different way of thinking from mine. It would have been better to have more time to get to know the other participants, before starting to work together*" [Anonymous]. For instance, the importance of the transdisciplinary approach comes out from this quote: "*The systemic thinking allows a dialogue with different professionals and experts and, in my opinion, will be the cornerstone for my complete professional background*" [Male, Master student, Forestry].

Students were asked about the role of universities in designing, integrating and realizing green and sustainable policy, the majority of the students pointed out a general lack in the capacity of creating a culture of inspiration, innovation, action and trust, through student engagement. *"Universities should be obliged to provide credits on SDGs and sustainability in general, because they are responsible for training and teaching us, also showing us how the universities behave, i.e. acting as a model"* [Female, Bachelor student, Economics] and, *"The role of universities is significant at this level since it affects the generation that is capable of effecting change. It should start by increasing awareness through projects and workshops and, later on, by implementing solutions and by letting students participate in finding solutions"* [Female, Master student, International cooperation].

All students also appreciated the link between SD and managerial skills, because, for most of them, the tools used during the workshop will be useful for their future working career. As one student said, "*we deserve such sustainability training also in traditional curricula because shortly, we will all be called to act in this sense*" [Anonymous]. Another claimed: *"The background developed during the workshop has certainly helped me to keep in mind the various aspects on which we worked during an exercise (conducted after the ESD workshop) on the theme of Geoparks"* [Female, Master student, Geography]. Alternatively, another participant declared*, "One of the main aspects of this workshop was the teamwork. Working with other students from different departments and seeking the same target through our different knowledge and capacities was a great motif"* [Female, Master student, International cooperation].

VI. Discussion

The pedagogy and its heuristic

The pedagogies chosen for the first part were mostly non-formal and unconventional. They ranged from serious collaborative games used for the simulation of multi-stakeholder dialogue to concrete managerial tools like Business Model Canvas, Ishikawa's Diagram, project cycle management, stakeholders' engagement techniques. Each of these tools were adapted to fit the module and the competencies developed during that process. As shown in Figure 1, the input-output linear flow can be discussed both regarding competences and managerial skills. It is worth noting here that most of the students joined the workshop with the intended purpose to develop their future business ideas linked to SDGs. Consequently, this pedagogy is suitable for running at an institutional level to get away from the compartmentalization of departments and schools.

Figure 1: *Input-Output process: each workshop module output provides the input for the next module. The top section shows the Education for SDGs part while the bottom one exhibits the Transformative process.*

[INSERT FIGURE 1 HERE]

In this project, transformative learning was two-fold. The learners became co-creators of knowledge and projects, and instructors became facilitators and guides (Cebrián et al., 2013; Iyer-Raniga and Andamon, 2016; Sunley and Leigh, 2017). The workshop proposed here is in accordance with recent literature on the importance of applied learning in Education for SDGs. For instance, in the work of Sinakou et al. (2017, p. 9), the authors affirm "workshops based on this approach [dialogue, reflection and critical inquiry] would encourage in-service teachers, who are often reluctant to get engaged with the academic literature on Education for SD". Sinakou et al. (2017) elaborates further: "we argue that Environmental and Sustainability Education Research should look for effective practices rather than focusing alone on barriers that diminish the potential of Education for SD".

The term heuristic can be defined as "(of a method of teaching) allowing students to learn by discovering things themselves and learning from their own experiences rather than by telling them things" (Cambridge Dictionary). According to this definition, the project presented here has had a different experience. At first, learners were "guided" towards the meaning and the use of managerial tools like Business Model Canvas, Ishikawa's fishbone, and other managerial frameworks useful in decisional making processes (Adams et al., 2011; Mader et al., 2013). Consequently, learners have used these tools to work with the SDGs to find a sort of rationality in the co-creation process (Scott, 2000). The future development of the business ideas created within the project assumes a critical relevance as it impacts the overall credibility of the Education for SDGs' implementation.

Most of the cases coming from the literature review show the importance of working for projects to support universities' strategies for sustainable development. Universities should be fertile grounds, and the workshop presented here might create a stimulus for such intrapreneurial activities (Braunerhjelm et al., 2018). Living Labs for SD projects will radically change the policies of universities that, in turn, will become more interconnected and pivotal actors for the SD of their territories. The effectiveness of transformative learning could be positively affected by universities as Living Labs, as students would see that even the university itself with its processes, policies, and management is transformed accordingly.

Criticism, implications and limitations

While the overall results can be evaluated as successful, the workshop is not free from criticism. Public universities and generalist universities might benefit from this workshop as the plurality of courses run by institutions are usually managed by disciplines within different schools or departments. The methodology presented here, by offering an extra-curricular activity, can be used to overcome problems related to administrative tasks and bureaucratic processes that generally are required to change traditional training offers. The authors agree with UNESCO in supporting the need to introduce SDGs in conventional training, and we acknowledge that this one-off workshop is not the optimal solution for directing all universities and their students towards SDGs. Even though, there is an urgent need for studies on transformative pedagogies at all levels, to allow learners to be able to start real projects in local communities, as explicitly required by UNESCO (2017). Furthermore, this paper presents a transdisciplinary approach to learning that is enforced by the managerial toolbox, that in turn is needed to help students in making their ideas and projects more concrete and sustainable (Abou-Warda, 2014; Adams, 2010).

The full cost of implementation of the workshop is low, and it is compatible with most of the sustainability teaching methods already presented by Lozano et al. (2017). Alongside the engagement of students, their empowerment becomes clear in the way that they can participate in a more systemic learning process, and they can directly benefit from the toolbox to complete their career. As such, this workshop is suitable as a fast-short-term action; it is easy to implement and change, varying the duration of modules or dedicating more space to develop precise competences or arguments. Although its duration might seem short, all the other cases of similar workshops reported by the SDSN Australia/Pacific have a similar length. Unfortunately, there are no studies on the methodology applied in these workshops and no evidence of transformative learnings strategies, if any.

Rationally, limitations are due to the necessity of conducting budgetary processes to realize business ideas and projects co-developed by students. This opens up the discourse on the greater importance that these types of initiatives might have for universities' management. University managers should consider this workshop as a way to engage students and external stakeholders (Disterheft et al., 2015). More significant results can be obtained by directing the Active Engagement phase to topics considered strategic by university managers, sharing part of the university budget and involving students in the process of accountability.

Further development of this workshop is needed to extend it to all types of public participants in demonstrating its validity for participants less interested in SD. Moreover, the workshop should also be refined regarding the vocabulary for SDGs, because as it emerged, the heterogeneity in the participants' backgrounds required time to discuss the meaning of single indicators and words. For the replication of these initiatives in universities, a critical discussion of its comparison with other initiatives and discussion of its technical feasibility require further investigations.

VII.   Conclusions

This paper ~~aimed to~~ discusses the essential elements of transformative learning that are needed to be considered ~~in~~ for developing a training experience around the Sustainable Development Goals (SDGs). Specifically, the Education for SDGs programme explicitly ~~mentions~~ highlights transformative learning as the natural evolution of pedagogies needed to transform learners into

leaders. ~~Unfortunately~~However, to date, there are only a few studies on transformative learning that can be applied to SDGs knowledge ~~are still rare~~.

~~This paper showcases an Education for SDGs activity carried out at the University of Torino Turin with the purpose of merging sustainable development and open innovation concepts.~~ In this case study, transformative learning is applied to SDGs with the primary outcome~~s~~ of sharpening learners' awareness and responsibility for the world they live in. Over the course of 2 days~~s course of 2 days~~, the programme ~~is~~ was conducted in 8 teaching stages, guiding participants ~~from~~ through ~~the~~ fundamental information ~~on~~ about SDGs in order to ~~the~~ design ~~of~~ a local ~~n~~ innovative project. It also involved the learning of SDGs' interlinkages and the exploitation of well-known economic approaches. The incremental learning process has been designed as an input-output model, and the results have been self-monitored through the use of the K-12 standard. This case study is innovative in the way it merges SDGs and active learning. The data collection is unique as it is based on sources such as video recordings and surveys, ~~and~~ as well as active participation by researchers in the project. This initiative offers practical tools to replicate the Education for SDGs and trans-disciplinary approach in other universities, public organisations and educational institutions. The module structure is divided into activities that follow in succession to allow the possibility to substitute or strengthen a ~~block~~ stage without compromising the flow.

~~Much work on T~~the potential of transformative learning has ~~already~~ been ~~carried out~~studied more in-depth over the past decade (Adams et al., 2011; Benavot, 2017; Lozano et al., 2017). However, there are still some critical issues that have not yet been applied to in investigating transformative learning, especially in developing potential solutions that contribute to supporting the SDGs. Our study ~~contributes to investigating~~aims to fill that gap by ~~investigat~~ing~~es~~ two specificities of Education for SDGs: the first is represented by the general elements of transformative learning that need to be considered in developing a training experience; ~~while~~ the second analys~~ies~~ is more in-depth and focuses on ~~which~~ managerial skills ~~are~~ that can be useful to ~~give concreteness to~~support Education for SDGs.

~~One of our implication, demonstrated and discussed in this study, Thus~~Our study points out~~is~~ that transformative learning and managerial skills can be interrelated. Managerial skills boost the power of transformative learning, prompting learners to take decisions and create actions in their local communities. ~~By C~~consequent~~ly~~e, the local community becomes pivotal in driving this experience to a successful outcome by several factor~~s. s (o reasons?)~~s.
First, the university management should be engaged and committed to ~~SD~~sustainable development ~~, not only~~ at a~~individual~~ and group ~~personal~~ level~~s, and~~ ~~but supported and~~ encourag~~e~~ sustainable action~~ed~~ through ~~their university's~~ institutional policy. Their commitment is necessary for implementing innovative ideas and projects after the end of the workshop and for demonstrating the relevance of such projects for their community. The relevance and the social acceptance of the students' projects impact the psychological conditions of the learners and can improve their self-esteem.

Second, the trainers, playing the role of guides ~~on the side~~ (King, 1993) shall be selected among those who match~~es better~~best with multi-disciplinary and trans-disciplinary teaching skills. It is essential for students that the trainers ~~will~~ not have any personal judgment and barriers ~~in~~ when ~~entering and touching wicked~~ approaching problems or discussing subjects out of their specific background. ~~Who D~~designing the workshop should no~~t t, therefore,~~ take the risk of providing a

superficial discussion~~s~~ on any of the subjects. This could ~~- of some~~ ~~any subjects. This would~~ may dampen the interest of the students~~, which instead, should be encouraged~~. ~~Making~~ T~~t~~hose who are ~~convinced~~ inspired ~~of the idea~~ by the materials from the training ~~truly engaged~~ can have a multiplier effect on the whole community, ~~. This multiplier effect~~ which speeds up social acceptance ~~by the community~~ about the willingness to make sustainable development a priority ~~goal~~.
~~Besides,~~ T~~t~~he ~~skills of the~~ trainers' ability to facilitate ~~towards~~ a trans-disciplinary teaching mode~~l~~ can be applied to ~~well approaches~~ managerial skills. ~~For instance (o moreover?), also~~ T~~t~~he administrative and technical staff could participate in such workshops in order to acquire the sensitivity necessary to offer support to projects or to manage administrative processes to help future projects ~~getting~~ become ~~concrete~~realized.

~~On the side of~~Regarding managerial skills~~ side~~, ~~our~~ this paper ~~contributes in giving gives~~provides ~~pieces of~~ evidence ~~about~~ on the importance of planning, forecasting, controlling, projecting, and accounting for sustainability impacts~~.~~ ~~,~~ This includes ~~as well as,~~ organi~~z~~sing ~~behaviour~~ ~~s~~ and manag~~ing~~e stakeholders' expectations. All ~~these~~ managerial skills are traditionally ~~implied~~ taught in business and management courses, but their application to sustainable development ~~issues~~ opens the margin of innovation. According to Lozano (2006), educational reforms are needed in conventional curricula, even ~~so~~if the economic viability of such reforms might hinder this radical change. ~~With~~ T~~t~~he driver of managerial skills ~~to~~ serv~~e~~es the purpose of developing future leaders ~~indeed~~, and the process of change might interest all the curricula in an integrated manner.

~~Gradually (o At first?),~~Over time, this workshop can be used as an extra-curricular transformative learning activity giving extra-credit to students.~~s~~ ~~, but~~ A~~a~~fter an initial pilot phase, it should be ~~adopted and adapted to match with the~~ adapted and integrated in current training~~s~~ ~~offer~~ to scale and ~~gain~~ build ~~the~~ momentum (Lozano, 2014). After ~~this~~ the ~~stage~~initial stage of establishment, ~~(o In perspective ?),~~ schools and departments will be responsible for ~~giving~~ providing more specific knowledge about SDGs as they ~~inside~~ apply to the traditional topics~~.~~ ~~, while~~ D~~d~~eveloping leadership skills for SDGs ~~might~~ is ~~become~~ a transversal activity, ~~such as the practice of other soft-skills. Moreover, soft-skills~~ represent~~ing~~s a useful way to ~~avoid taking SDGs out of context, detaching them from real life and~~ strengthen~~ing~~ one's soft skills, as well as enhancing collaboration between academia and society as a whole.

Universities have been called on to expand their role ~~for~~ in sustainable development, including analysing their commitment ~~alongside the fulfilment of~~to ~~their~~ social and environmental responsibilities. A~~n effective~~ ~~real~~ response that both public and private universities ~~, especially the public ones,~~ can offer~~,~~ is to bring students closer to a different way of understanding leadership for SDGs. The workshop presented here ~~could~~ aims to generate a positive return for universities, not only in educational terms, but also concerning the ability to transform learners into conscious citizens, able to take an active and proactive role in ~~their~~ society. Finally, the case study presented can also be described as a stakeholder engagement activity, which ~~one that~~ reinforces sustainability assessments, and ~~which~~ can be acknowledged in the ~~organisation~~ organization sustainability reporting.

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Table 1 Rationalization of the hermeneutical unit of the study

Time frame	The steps of the Workshop	Unit of analysis	Codification
Prior	Important for selecting attendants to the workshop	70 online questionnaires filled	Online answers both closed and open. Open answers were focused more on personal interest in SDGs
Concurrent	Negotiation Game	Five posters elaborated by students representing categories of university stakeholders	Written posters, notes taken during the discussion
Concurrent	Project Cycle Management	17 Root Cause Analysis Tree Diagrams (one for each SDG)	Researchers assisted without intervening. Posters were collected as part of the unit of analysis
Concurrent	Visual Thinking	17 Ishikawa diagrams (one for each SDG)	Posters were collected as part of the unit of analysis
Concurrent	Presentations of SDGs	Nine videos of three minutes length	Recorded videos
Concurrent	Brainstorming Ideas	5 Business plans using Business Model Canvas	Posters were collected as part of the unit of analysis
Post	Feedback	30 online questionnaires completed	Online answers, mostly open, about general feedback on the workshop experience and the learning outcome on SDGs

Table 2: *Past experiences and future projects of participants*

What they have done in the past	*Answers*
Collaboration with associations and cooperatives on themes linked to sustainability	8
Co-sharing and regeneration of urban spaces	5
Collaboration in associations not related to sustainability issues	4
Extra-curricular courses and workshops on SD	4
Project development in university courses	3
Collaboration with the Green Office of UniTo	2
International cooperation experiences	2
Management of an association	2
What they would like to do in the future	
Develop a mission-oriented entrepreneurial activity (businesses for sustainability)	7
Develop projects for the university	4
Develop their own short-term projects	3
Continue to collaborate with an association to develop projects even further	2
Business and project ideas	2
No ideas, but they would like to join projects in the future	7
No answers	5

Table 3: *The first part of the workshop dedicated to a fundamental understanding of SDGs*

Module	Description	Aims and rules
What are the SDGs?	This module is organized as a game where each participant represents one of the 17 goals.	Each participant presents a single SDG, and, during the game, the participant will be interviewed by others in turn, to share knowledge and explore the SDGs.
The Negotiation and Conflict Management activity	This shows how to connect SDGs to deal with multi-stakeholders' problems.	Students are split into groups. Each group represents a particular stakeholder involved in the case study. For instance, the game focused on the freedom of education and access to education. Thus, the stakeholders were students and their families, the Ministry of Education, the University Board of Directors and Academic staff.
The Project Cycle Management (PCM) activity	This introduces SDG targets and indicators.	Students learn the PCM approach and how to apply it to SDGs. The aim is to demonstrate the interconnection among SDGs through the identification of common/similar targets. The activity consists of drawing "root-cause tree graphs" related to several SDGs and comparing the graphs for different SDGs.
The Visual Thinking activity	This introduces basic tools to analyse an issue using a visual approach.	Participants are split into different groups. Each group analyses an SDG in detail. For this purpose, different analysis approaches may be adopted. In this case, the *Ishikawa diagram* (Ishikawa and Loftus, 1990) was used, an in-depth root-cause analysis which allows to identify up to third-level causes. From the commonly identified causes, students may understand the interlinkages between different SDGs.
The Leadership and Public Speaking activity	This is based on the simulation of an interview to stimulate participants to speak in front of a camera.	Participants are split into groups of a minimum of three persons. Each group must choose one SDG, two people who take the role of experts on that goal and one person who acts as the interviewer. The activity consists of simulating a 3-minute television interview based on three questions: 1) describe the SDG, 2) what is the main problem related to that goal? 3) describe possible solutions to the presented problem.

Table 4: *The second part of the workshop dedicated to the elaboration of business ideas to support SDGs*

Module	Description	Aims and rules
Brainstorming idea	This module is focused on elaborating projects within the local student community.	First, each participant has to present a project idea related to a real-world problem in his or her community (neighbourhood, city, university) and a possible solution that links as many SDGs as possible. Second, participants select the most promising ideas and, working in multidisciplinary teams, have to define potential projects through a business model canvas.
Pitch and Presentation	This develops learners' ability for problem-solving through the elaboration of a management solution. The communication of the idea in front of a commission serves the purpose of stimulating commitment in learners.	This aimed to deliver short presentations evaluated by a jury of stakeholders.
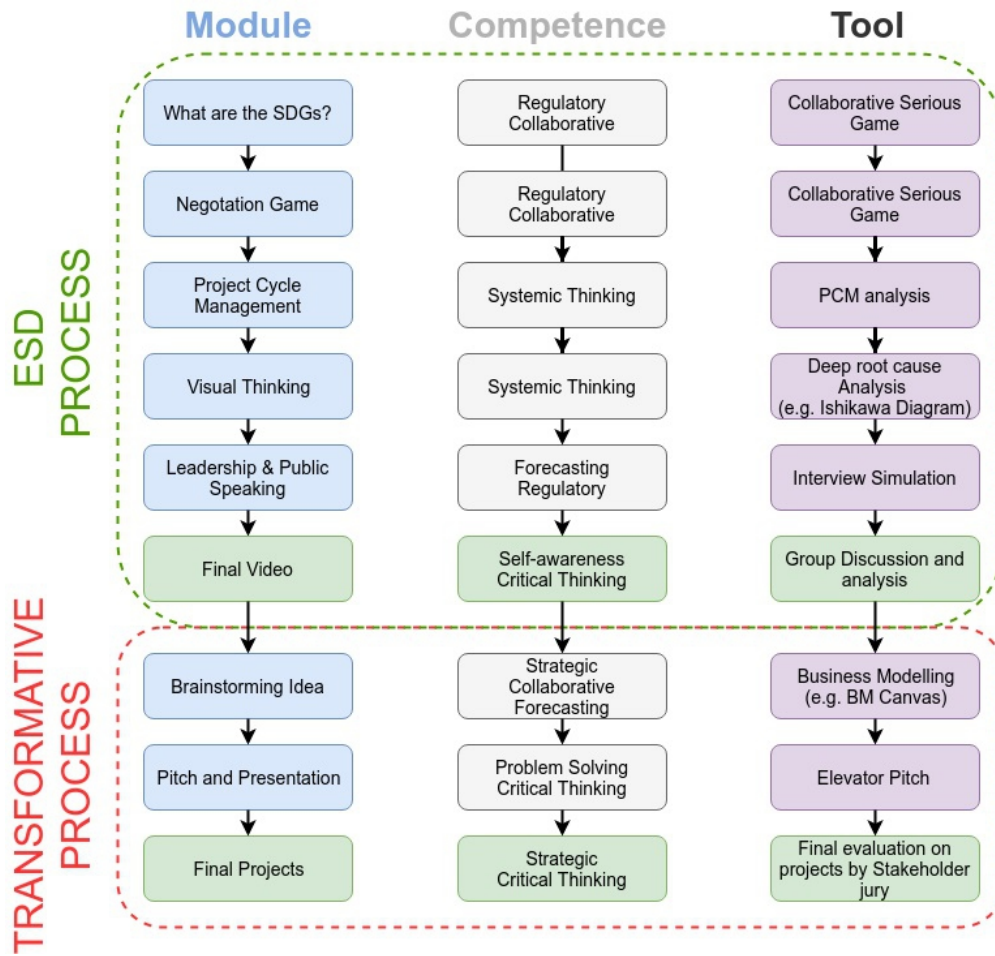
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