How the Structures of a Green Campus Promotes the Development of Sustainability Competences. The Experience of the University of Bologna

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Abstract Pursuing sustainable development in universities is not just a political issue or management issue of the universities. Strategies and action plans are only partially useful if they are not accompanied by concrete actions in teaching, in research and in the outreach as well as the development of physical structures that respond to the principles and criteria of sustainability. Many universities made steps in this direction, making green their campuses. It lacked, however, the awareness that the "physical structures" can effect learning, allowing students to develop skills useful to promote sustainable lifestyles and they become professionals "of the future capable of." This paper aims to highlight the educational function that the University of Bologna has developed through the changes implemented to the plexus structures "Terracini" of the School of Engineering and Architecture. Through a series of interviews with key observers (students, faculty, staff), the paper illustrates how, even enhancing the leading role of the students, the campus has become a real "living lab" in which design new ideas, test participation initiatives and concrete realization of the projects, teaching and dissemination of good practices. In other words, it is a starting point for the promotion of social, educational and research the principles of sustainability.

Keywords Education · Green office · Participation · Structures and places · Sustainable development

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1 Introduction. Sustainable Development and University: The Importance of Make Structures and Places Sustainable

Universities were the first institutions to work toward sustainable development (Wright 2004; Stephens et al. 2008), expressing their commitment through the subscription of numerous international declarations, such as the Talloires in 1990, when the world commitment of universities for sustainability officially began (Huppè et al. 2013). Over the years, universities have focused on important aspects and responsibilities, in line with their main missions: preparing students for the future, researching the causes of global challenges and hypothesising solutions, developing good practices through governance and the management of resources in close relationship with the local community.

The universities' commitment for sustainable development is not a mere "formal" issue, but on the contrary, it is made of concrete actions (Leal Filho 2011) such as: curricula's transformation, the changes in campus structures, the research towards sustainability issues, the implementation of lifelong training courses, the implementation of concrete projects with and for the territory and the creation and management of relevant information and knowledge (Karatzoglou 2013, p. 45).

The risk, however, that this commitment may lead to a "systems failure", due to the "continuing inability to sufficiently adapt to our social and economic systems to their ecological context" (Sterling 2004), is very high, especially related to several challenges that the university is asked to face (Leal Filho 2011):

1. the need of a wider sustainability interpretation as well as the responsibilities that every country and every citizen has in its implementation;
2. the need to better communicate sustainability to different nations and to different kind of public to make it understandable and to encourage the involvement of all countries (regardless of their economic situation), as requested and underlined by the Agenda 2030;
3. the need to make sustainability concrete and operational. Together with the considerable number of studies and publications, more good practices, projects and case studies need to be disseminated in order to show what can be done and how.
4. the need to increase the support for sustainability through (Leal Filho 2010): an understanding of the university role in the implementation of sustainable development, on the job training interventions for academic staff on sustainability issues, the creation of research centres and/or working groups to discuss the best way to pursue sustainable development through specific initiatives, the development of partnerships and networks (inside the same institution and between different institutions) for the exchange of ideas, experiences, best practices, creation and implementation of specific projects.

Taking care of sustainability offers universities the opportunity not only to generate new knowledge but also to contribute to the development of sustainability skills, and the awareness about this issue. Considering sustainability as a guiding principle

of universities can also facilitate institutional change, making it systemic and providing spaces for critical and transformative thinking, making sure that the university itself plays an important role in the society transformation (Barth and Rieckmann 2012).

This process can be speed up if it is supported by training interventions, which are implemented not as just a redefinition of the curricula, but including specific aspects of sustainable development. An increasing number of universities (e.g. Oberlin and Portland State University) use buildings and facilities as tools to educate on sustainability. Campuses are considered real "living laboratories" where students can experience the link between the theories and the knowledge learned in the classroom and real cases from local reality. The living laboratories promote, in fact, students' full participation in the change for sustainability through their active involvement in the choices and actions to be performed in the campus. This participation increases their civic commitment in the improvement of local communities' internal sustainability processes (Hansen 2017, pp. 225–226).

Although there is plenty of literature on what students should learn about sustainability, there are few studies on students' perception of the actual usability of their learning for sustainability (Carew and Mitchell 2002) even in their own university. Indeed, there are limited participation opportunities for students in the sustainability development of their university (Nejati and Nejati 2013). Hicks (2002) acknowledges how "the emotional impact of global issues on students learning is still a neglected area of research" and highlights the necessity of pedagogical paths able to develop students' sense of hope and empowerment, because global problems also imply emotional involvement (Hicks 2002, p. 99).

Promoting the development of a sense of responsibility through university implies that each student perceives himself as an agent of change for sustainability and develops skills necessary to face sustainability challenges.

This contribution aims fill this gap by presenting a university teaching experience that enhances the role of students, their participation and their responsibility for their university's sustainability.

The Green Office model, born and developed in the last years in Northern Europe, has the objective of the creation of a "hub" managed by the students with the close collaboration and supervision of the teaching staff and administrative staff, in order to promote sustainability actions and to propose itself as a model for the local territory.

2 Educating for Sustainable Development: Political Dimension and Need for Participation

Sustainable development's education, even at university level, is currently having a strong international (both as a result of the Decade of Education of Sustainable Development and following the definition of the UN Agenda 2030) and national momentum (with the National Development Education Plan for Sustainability of

the Italian Ministry of Education, University and Research 2017). However, there is still much to be done: a cultural and structural change inside the universities, which is inevitably complex and requires the involvement of the entire institutional community, can occur more easily with a clear, precise and consistent educational commitment on sustainable development and its challenges (Sterling 2001).

As Morin stated (2015, pp. 36–37), there is still the opposition of the current training systems to provide the tools for questioning and reflecting on the good life, because the teaching is still faulty and strictly associated to specific fields considered not to be interconnected.

Educating for sustainable development is much more than teaching what sustainable development really is, because it involves actually experiencing sustainability: it is practice and theory together, sustainability principles integration in everyday life. For this reason, universities sustainability experiences are more effective when supported by training courses focused on "a learning-by-doing approach that can demonstrate how to answer the multiple challenges of sustainability" (Cappellaro and Bonoli 2014). Education for sustainable development is in fact interdisciplinary, collaborative, experiential and potentially transformative; it produces spaces to think, inquiry, dialogue and act (Moore 2005, p. 78). From this perspective, education can be considered as a driver for change: investing in education means investing in and for the future.

The sustainable development education goal is, in fact, to make students able to imagine alternative development practices and to participate in the increasingly necessary processes of change. Only the full understanding of the political dimension of sustainable development education will make it possible to acknowledge education as a specific community and social need that requires: learning methods able for enhancing real experience as an instrument of authentic knowledge (Dewey 2014); development of skills for sustainability (Brundiers et al. 2010; Brundiers and Wiek 2013; Thomas 2009) and promotion of effective thinking that comes from the living experience and constantly refers to it and that sees reality as an instrument of continuous comparison (Mortari 2008, p. 38).

Fostering the development of a sense of responsibility through university courses let each student perceive himself as an agent of change for sustainability. In an uncertain and rapidly changing world, higher education acquires an increasingly significant role in helping students to be active and responsible citizens and can become a laboratory of democracy and civil commitment in which everyone contributes to the common good: "to improve education we need to get out of the classroom and think about our community's problems, seeing the territory as a space for participation and learning that commit us to develop relevant knowledge. The proposal is to stop considering […] young people only as a hope for the future or as beneficiaries of assistance and inclusion policies, but to offer them the opportunity to be active agents of the present" (Nieves Tapia 2016, p. 4).

Place-based education paths are undoubtedly very useful for this purpose. In fact, this kind of interventions contextualize knowledge, content and skills within experiential and multidisciplinary learning environments and promote useful actions for the community (Gruenewald 2003) and the community-building (Schild 2016,

p. 20) as they refer to direct aspects of students' daily life (Palberg and Jari 2000; Leeming and Porter 1997).

The creation of "good" citizens requires an education of young people to participate in their communities life and to establish a high quality relationship with them. Participating is "thinking together about community life problems, looking for solutions together, comparing them, and then, through the dialogue, choose the right option" (Mortari 2008, p. 54). For this aim, projects of living lab and active students' participation are very important in universities.

As stated in the 1992 Rio Conference, participation is a fundamental requirement for sustainable development. Chapter 36 of the Agenda 21 Document (United Nations 1992), in fact, calls for encouraging participatory processes on sustainability by giving undisputed value to education at all levels. Participation allows a general change in the reference paradigm and contributes to the dissemination of sustainability culture in universities.

The students are more and more aware to the themes and issues of sustainable development (UNESCO 2014). They are thus called to interact with the other community members to develop an understanding and to set up actions able to change the current situation. They are no longer spectators but key players for their university's sustainability. This is why much more needs to be done to involve students in higher education transformation processes in order to increase their sense of responsibility, to foster their emotional involvement and to develop empowerment and hope (Hicks 2002, p. 99).

One of the strengths is undoubtedly linked to the reduction of the gap between what it is said in the classrooms and the perceived sustainable development requirements at an economic, social and environmental level (Kajikawa 2008). Unfortunately, there are cases in which students "found that what they have learned is so unrelated to real life situations not to give them any control over it" (Dewey 2014, p. 13). There is the need of quality experiences, able of influencing further and future experiences. The dialogue, the comparison and the interaction clearly represent an opportunity for common growth, favoring the construction of a life project, promoting active and democratic participation and opportunities of growth at several levels: personal, university community, local community and global community.

3 Participation in Practice: The Experience of the "Terracini in Transition" Living Lab and the Creation of the University of Bologna's Green Office

The Green Office of the University of Bologna is intended as a hub for students as drivers of change together with universities and cities. Based on the Northern Europe Green Office projects, it has been designed inside the participation in an European

project Horizon 2020 about the regeneration of urban areas in the university of Bologna zone.

The Green Office can be considered as "an organizational niche" where new experimentation practices take place. It is a catalyst for change that allows a larger involvement of students in the University's efforts towards sustainability (Spira and Backer-Shelley 2015, p. 211).

Through confrontation, students develop a strong critical thought, seen as the development of "refined logical and argumentative skills [...] on the basis of a continuous confrontation with the most important social, economic and political questions" (Mortari 2008, p. 38) related to their university. Teachers, students and technical and administrative staff design, discuss, imagine and experiment sustainable solutions; together they grow, together they educate themselves and feel co-responsible for the choices and the measures to be implemented. The Green Office is therefore a dimension of personal and social growth in which each actor of university life recognizes its role and its responsibility to start an important process of institutional, urban and human regeneration.

The Green Office of the University of Bologna stems from the experience of the "Terracini in Transition" Living Lab of the School of Engineering.

4 Methodology

The living lab has been studied to outline its strengths or weaknesses and to value its replicability and its enormous potential to create more structured, broad, multidisciplinary projects that involve the entire university community and deeply interact with the city and the local territory. This study presents a "on the field" research about "Terracini in Transition" through direct interviews with its main actors.

This research aims to investigate, through a qualitative exploratory research, the perception of:

1. the potential that the participation to the Living Lab of "Terracini in Transition" has for the university transition towards sustainability;
2. a possible relationship between the participation in the Living Lab and the development of skills for the creation of the future Green Office and sustainability actions at city level, specifying which actions are undertaken;
3. if and how knowledge and skills acquisition can be encouraged by university's facilities;
4. how much Green Office participation can increase sustainability in the university's own city.

Interviews were carried out from September 2017 to February 2018 with thirteen members considered privileged observers (four members of the technical and administrative staff and nine students) of the "Terracini in Transition" Living Lab of the School of Engineering and Architecture of the University of Bologna. This

meant that they became part of the sample of this research (reasoned sampling). The interviews were carried out at the Terracini Campus of the University of Bologna.

Interviews were conducted according to an informed protocol including 5 questions, administered in a specific order from the most general questions to the most sensitive ones. The questions were not provided in advance to the interviewees to avoid any biased responses and attitudes (Vitale et al. 2008). The answers were digitally recorded and manually transcribed. The interview transcription was sent to each interviewee to be approved.

The use of semi-structured interviews facilitated the understanding of the Living Lab experience by giving participants the opportunity to freely express themselves and allowed to obtain rich and various data (Bryman 2012).

The content of the interviews were compared and emphasis was placed on similarities and differences, as well as on relevant aspects emerged during the interviews. A rigorous analysis of the collected material and the suspension of judgment allowed to limit the risk of subjectivity that may arise in interpretative research.

5 Data Analysis and Main Results

5.1 Potential for University's Transition Toward Sustainability

Regarding the Living Lab potential in the creation of a university Green Office and in the transition toward sustainability of the University of Bologna, no differences were found between the administrative staff and the students. In particular, the main detected potentials were:

1. educational
2. relational (creation of new relationship and recovery or strengthening of the existing ones).

The educational potential is expressed in the increasing awareness on environmental and sustainability issues, making clear a particular interest on these topics: "Although there is the decentralized department of environmental engineering, the environmental component is strong … however, entering this department no one notices it. Instead "Terracini in Transition" means that there is clear attention to these issues and therefore allows those who are interested to get in and collaborate. […] Moves consciences" (F.L.). The word "conscience" echoes in the words of S.P. according to which "everyone should try to carry forward a sustainable conscience … The university should support this and students should be interested in these issues".

"Terracini in Transition" is view as a "connection for practices that can help everybody with examples of sustainable actions" (E.F.) but also as a "big educational and teaching tool because it changes the point of view […] the teacher is not anymore the only one that provides knowledge and solutions

but the solutions are designed with the students […] that is how we become a community useful for other communities" (F.C.).

Participants of the project report another important potentiality of their activity: creating and reinforcing the relationships between people and disciplines. E.S. highlights this aspect very well: "I really like the interdisciplinary … [students of] management engineer, mechanic engineer and civil engineer understand that these issues concern not only someone but everyone. The *Living Lab* allows us to know each other outside our groups … which is an important aspect … because we are very sectoral and we know it. It's chance to know each other and to improve, which is always good".

5.2 *Relationship Between Green Office Participation and Skills Development*

Sustainability undoubtedly places new challenges for our societies that require creativity, self-organization and transversal competences that the university often does not provide but are essential to create citizens for sustainability.

The word competences describes the specific attributes that individuals need for action and self-organization in various complex situations and contexts. They include cognitive, affective, intentional and motivational elements; therefore, they constitute an interaction of knowledge, skills and abilities, motivations and affective dispositions (UNESCO 2017). Skills can not be taught but must be developed by the learners. They are acquired in action, based on the experience and the reflection (UNESCO 2014).

There are specific skills that are considered essential for sustainability (see de Haan 2010; Rieckmann 2012; Wiek et al. 2011): systemic thinking, prevision, regulation, strategic, collaborative and critical thinking, self-awareness, problem solving.

Can Green Office participation develop competences? Which competences are involved and who develops them?

All the respondents agree that being part of the Green Office and participating in its projects provides the development of personal skills useful also for the students' professional future.

Even though is widely agreed that Green Office is helpful for the development of technical competences, all the interviewee agree that it fosters "practical and transversal competences" (D.P.) as well, in other words soft skills. In particular, E.F. highlights that, through Green Office, it is possible to "go outside the borders of theory and get into the real practice". This pushes participants to "deepen topics that are not covered in academic lectures" (S.P.) and let students from different university courses or university staff from different roles understand the importance of looking at problems with an interdisciplinary perspective (S.P. and F.C.).

According to the interviewees, the dialogue and the collaboration between disciplines and between people and institutions, represents the most developed sustain-

ability competence in the Green Office. The University of Bologna considers this competence very important, not surprisingly the Green Office has scheduled a series of training sessions on team working (F.C.), based on the fact that is one of most requested competences by companies. This tendency to promote collaborative competences between companies and the world of work has also emerged from the words of E.F., who underlines how this collaboration is "new and more intense" compared to university everyday life: "this is a great added value, in fact the Green Office is a real link between university and the labor market".

The other soft skills that are most likely to be developed through the Green Office are:

- Problem solving competence linked to forecasting. "The opportunity to think and try to implement specific projects let you clash with reality … And then you have to meet technicians and politicians and maybe you argue with them and they ask you to go through long and difficult bureaucratic procedures […] Participating in the Green Office puts you to the test … and makes you realize how real life projects are difficult to manage and you have to consider always the negative aspects" (E.S.).
- Design and project management that pushes to "apply the knowledge learned during the lessons in real situations that are closer to the world of work than students' life" (F.C).

The Green Office represents, therefore, a tool of self-education (for participants) and of education (institutions, organizations, businesses that work together) to sustainability and, according to the interviewed technical and administrative staff, represents especially for the non-teaching staff an added value in terms of commitment to sustainability.

5.3 University Facilities for Training to Sustainability

The project "Terracini in Transition" and the students' Living Lab were born to address the issues of "concrete" sustainability: "What can we do for the sustainability of the Via Terracini Engineering and Architecture School? Are there any places in this facility that communicate sustainability? Which are these places? Which are the difficult places? How can we improve them?" (F.C.).

Starting from the Transition Towns Movement principles, Terracini's Transition project shows how is possible to make a change and to educate starting from the places: "a vegetable garden … a abandoned place that is regenerated … the transformation of places has a very important impact on the participation and the involvement of citizens and students in sustainability and transition projects", continues FC "If there are places and structures where sustainability has been taken care of, people will wonder why. It is a start … A practical way to wake up consciences".

The places are, therefore, a crucial element to educate to sustainability because they allow people to "touch" (P.D.) and to "visualize" sustainability (M.C.). In particular, those who took part of Terracini in Transition of the University of Bologna have

designed an experimental "green roof", which represents an interesting example of sustainable solutions placed into concrete actions of teaching and applied research.

Through the Terracini in Transition green roof project the group had the opportunity to participate to important European projects, to be known also in the city context, and to make themselves available to the community. "We are a very small reality that has grown a lot … Being well known outside is a great resource […] a great victory. The practices we developed with the Green Office are laboratory practices for the growth of sustainability in the city of Bologna" (E.S.).

The importance of what has been done in Terracini's facility should focus the attention on keep working in an overall University perspective through the development of a true student Green Office that is multidisciplinary and strongly contextualized within the city, sharing common competences and objectives, because "if it is true that much has been done … it is equally true that there is still much more to do" (D.P.).

5.4 What the University Green Office Can Do for City of Bologna's Sustainability

The city is the main place where the future of sustainability and human beings is played. It is fundamental, then, that the university offers its services to the city and starts a dialogue with it to plan together solutions for the local territory.

This is what arises from the interviewee when were asked if the link between the Green Office and the city of Bologna allows a sustainability growth.

The majority of respondents (eight) recognize the strong link between the city of Bologna and its university: unlike campuses in Northern Europe where the model of the Green Office was born, Bologna is "the ultimate university city: the university is inside the city and Bologna would not be what it is without its university" (F.C.).

Despite this, actually the bond established between students and the city is not ideal. Students end up not fully living the city and they give back very little as a consequence. The Green Office can be a tool where "the student (even those who live outside the city) can feel part of Bologna, a citizen of Bologna because he is committed to the well-being of the city" (J.L.) and can "get involved … with all the knowledge learned in class" (F.L.). Once again, comes out the strong educational value of the Green Office, an experience that arises from confrontation but also from the sharing of what one knows and what one is. It is no coincidence that "without the relationship with the Municipality and the city, the Green Office would be an end in itself" (M.C.) and "there would be no sustainability" (E.F).

Everyone benefits from this link: all the interviewees think that:

- the city benefits because the Green Office work "produces solutions that benefit also the city … the developed practices can be repeated in other places … For example it would be great if the municipality recognizes the importance of green roofs and decided to create a network of green roofs …" (F.C.);

- students and university communities citizens and future generations benefit (M.C.);
- associations benefit because "the Green Office is a tool for dialogue between associations that deal with sustainability but often fail to collaborate" (E.F.).

Clearly, as almost all the interviewees point out, there are "inevitable bureaucratic and coordination problems as they are big institutions … and … it is difficult to establish a dialogue" (F.L.). At the same time, however, everyone is aware that a full collaboration requires both institutions to give up on their self-centeredness.

Only in this way, the University and the Green Office can be a "locomotive of sustainability" within the city (M.C.).

6 Conclusions

The experience of the Green Office of the University of Bologna, described in this paper, strongly highlights the importance of the role of education for a campus that wants to define itself as "green". This education goes beyond lectures and requires innovative approaches that can guarantee a better understanding of sustainability and how it should be designed in all areas of university life.

What makes the Green Office a highly educational experience is that all the participants bring their own life, experiences, previous knowledge, skills to make them the best use and to build new ones (Calvano 2017):

- It benefits students: they learn how to design solutions and make the best use of the knowledge learned during their studies; they have the opportunity to get in touch with companies, institutions, associations, local authorities, developing social, relational, problem solving and transversal skills; they perceive themselves as a living and active part of their university. No longer just students but main actors of their university community.
- It benefits teachers which can count on their students' creativity and commitment for the design of new strategies and solutions; which can consider their teaching in light of the skills required of students from the real problems they are facing.
- It benefits the technical and administrative staff who, working for the growth of their university's sustainability, find themselves, like the students, as main actors of the university community and the creators of change.
- It benefits the whole university, in a third mission view able to go beyond the assumption that innovation is the exclusively technology, rediscovering the inevitably social nature, where the dimension of service to the community is the "sine qua non" condition for everyone's growth.

This study underlined the support that a living lab like the Green Office can give not only to the sustainability development of the university and the city, but also to the students' increase of participation and responsibility toward this issue.

Although the results of this work are positive, there are some undeniable limitations:

- as a case study, it is strictly related to a specific contest and time. It would be necessary to repeat the research longitudinally (interviewing new students of the Green Office of the University of Bologna in 3 years) and in different places (repeating the study with students from other universities where there is a Green Office);
- there is the possibility that the enthusiasm about sustainability development is mainly of the teachers that took part to the Green Office and less of the students who's commitment could be just a compliance to teachers' requests;
- it can not be excluded that students empowerment experience about sustainability's issues can be limited to Green Office and to the university context and does not transfer into a concrete commitment in their everyday, personal and professional life.

Further studies, currently ongoing, are trying to fill these gaps.

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