

Environmental education and its contribution to sustainable cities

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Abstract

Introduction. In 2050, the human population will reach 9.7 billion people, and more than 5 billion will live in urban areas. Anthropogenic pressure on natural ecosystems has been progressively increasing, and it has reached worrying levels with severe economic and social repercussions. From an ecological point of view, cities act as a hetero-trophic system. They import raw materials, transform them, and dispose their waste, mostly in faraway places. Therefore, the city is an unbalanced system needing more and more rural spaces which are functional for finding resources to continue developing and progressing. This article highlights the importance of environmental education in sustainable city building processes in South European cities.

Materials and Methods. As the European Union has intensified its engagement in sustainable cities, only cities awarded by European green capitals were included. Cities from North Europe have been excluded since environmental education has been developed previously. The methodology used in this analysis is the case study.

Results. Environmental education is a process that allows people to learn about environmental issues, solve problems, and take action to help the environment. Two cities were included in the analysis: Nantes and Lisbon. Nantes' strategy was to draw attention to the housing problem, improve urban life quality and active participation of citizens in future community choices. Lisbon planned to increase soft mobility, construct new bike paths, and improve the public transport network.

Conclusions. The analysis of the two cities, conducted by a comparative methodology, shows the potential intervention areas and indicates how environmental education contributes to a sustainable city. Together, Nantes and Lisbon applied an environmental education strategy based on citizens' participation, involvement, and education. Similar strategies are recommended for the future development of more sustainable cities.

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Environmental education contributes to the city's sustainable development, promoting awareness among people of ecological problems. At the same time, it stimulates the growth of operational skills, such as a sense of initiative and the ability to assume and take responsibility.

Keywords

Ecosystem; Sustainability; Sustainable city; Education; Environment; Europe, European Union.

Introduction

Within the next few years, more than half the world's population will be living in urban areas (United Nations, 2019)¹ Simultaneously, cities are crucial contributors to climate change, as urban activities are major sources of greenhouse gas emissions. Estimates suggest that cities are responsible for 75 % of global carbon dioxide emissions and transport and buildings are the largest contributors (Satterthwaite, 2008 [19]). As a result, cities must improve policies focused on sustainability and a better quality of life for their inhabitants. Concrete experiences to achieve this objective have already been achieved in several urban centers of the advanced world, such as North European countries. According to the United Nations (UN) projections, the Earth will reach 9.7 billion individuals in 2050. This means that the environmental impact and climate change will become a severe threat to human health. Thus, more sustainable environmental management of urban spaces is urgently needed with a more balanced relationship with extra-urban areas.

The theme of sustainability originated in the 1970s, during the 1972 *United Nations Conference on the Human Environment* in Stockholm, where the need to plan economic

development compatible with the conservation and protection of the natural environment became evident. In the 1980s, *the UN World Commission on Environment and Development* formalized what would be the definition of sustainable development (from the *Brundtland Report*), which is still the best known and most accepted in the various scientific fora: “Development that meets the needs of current generations without compromising the ability of future generations to meet their own needs” (*World Commission on Environment and Development*, 1987)². In 1992, Rio de Janeiro Conference (*United Nation Conference on Environment and Development*) produced an implementation tool capable of implementing a process of sustainability for urban communities: the so-called “Agenda 21” (from the gerund of the Latin verb *ago*, things to do for the 21st century)³.

Based on the document, four different contents can be found: 1) the different economic determinants and social dynamics; 2) environmental issues; 3) political dimension; 4) way of implementation. During the *World Summit on Sustainable Development* in Johannesburg in 2002, many critical issues were highlighted to the failure to implement the previously developed theories. In 2012, the

¹ United Nations World Urbanization Prospects: The 2018 Revision, New York, 2019. URL: <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>

² According to some authors, despite the vagueness of this definition, the strength of the latter lies in its plural dimension, in the juxtaposition of economic, social and environmental dimensions that involves organic

integration and does not limit itself to inserting the environment into the economic discourse to evaluate only its externalities (M. Tinacci, 2008 [21]).

³ For further information one can consult the documents of the UN Conferences on the website: <https://www.sustainabledevelopment.un.org> in particular: Agenda 21 (1992); Johannesburg Plan for Implementation (2002); The future we want (2012).

international confrontation continued at the *United Nation Conference on Sustainable Development* in Rio de Janeiro, held during the darkest period of the world economic crisis, which, perhaps more than the previous conference in Johannesburg, underlined the urgency of launching virtuous paths of sustainability, mainly in urban areas (Flint, Raco, 2012 [13]).

On the subject of urban sustainability, there is no real founding document in the literature that can be considered a starting point. However, in the wake of the UN World Conferences on Environmental Protection, several international documents and studies can be identified that, over time, have contributed to the current idea of urban sustainability (Wheeler, Beatley, 2004 [23]). Therefore, the theme of urban sustainability, as it is understood today, originated in the last decades of the last century in response to two different emergencies that arose during that period. The first theme concerns the increasing environmental problems originating from the many ecological crises in different parts of the world. That has contributed to spreading a greater environmental awareness in broad strata of civil society. Instead, the second is linked to the deteriorating living conditions and environment of the major urban centres. In fact, in most of the advanced world, we have moved from the crisis of the industrial city characterized by polluted and unlivable spaces to the post-industrial city where environmental and social rehabilitation actions have been the dominant feature in recent decades, often accompanied by land speculation (Whitehead, 2012). In this context, some cities have started and experimented with a righteous path towards applying the principles of sustainability, already indicated by the United Nations Human Settlements Programme (HABITAT programme, since 1976) underlining the need to restore polluted and unlivable urban environments.

At the European level, sustainability has taken on a leading role as a defining element of the standard policy, first with the European Community and then in a more incisive way with the European Union. The theme of environmental sustainability is at the heart of the European Commission's Environmental Programs that have regularly followed one another since 1973. In line with the principles of sustainability, since the Fifth Program of 1993, several actions and measures were launched to improve the environment of cities. *ICLEI Local Governments for Sustainability*, an association of local governments that have been promoting urban sustainability since the Aalborg Conference in 1994, with the support of the European Union, has also produced a “Charter of Intent and Principles of Urban Sustainability” that has been signed by all European cities and towns determined to embark on a path towards sustainability through the instrument of Local Agenda 21. Since then, a *European Green Capital* competition/prize for the continent's most sustainable city was also established by the European Commission, for the first time awarded in 2010.

As is made clear by copious studies on the subject, sustainability encompasses several dimensions: environmental, economic, social, political, cultural, and territorial (Whitehead, 2007; Bagliani, Dansero, 2011 [3]) which interact strongly with each other, that it is not easy to analyze them individually without considering the whole context where they develop. These, in turn, can be grouped in the three components of sustainability (environmental, economic, social). Through a given political choice, the urban community that intends to initiate a path of sustainability can choose and adapt to its needs, which component or components it prefers. For the sake of brevity, this contribution will only deal with the environmental component, and to this end, it is necessary to introduce the concept of the

urban ecosystem (Nicoletti, 1978 [17]; Alberti, Solera, Tsetsi, 1994 [1]). This study approach in Italy was used for the first time by Nicoletti (1978), when, for different reasons, citizens' environmental sensitivity had a considerable increase.

The themes of the environmental crisis and quality of life in large urban agglomerations have determined the interest in an innovative approach to the study of the city compared to the past, interpreting it no longer as a linear system based on the import of raw materials and energy from outside and the subsequent disposal of waste, therefore in total imbalance with the external environment. However, on the contrary, it is interpreted as an ecosystem in which various natural and human elements that generate more complex realities coexist and relate. In this way, even urban settlements represent one of the places of deepening of ecology⁴.

An example that can be traced back to the ecosystem approach is that of the eco-city that in planning values environmental elements and economic and social ones. Its origin dates back to 1975 with the foundation in Berkeley (USA) of the association Urban Ecology, founded by Richard Register, an artist and activist who was among the first to promote an ecological approach to the city. In the 1980s, the debate began around this association on implementing a more sustainable city. In summary, these principles are (Tononi, 2015 [22]): a limited consumption of land to create a compact city, a transport organization that enhances walking or cycling, the reclamation of damaged environmental areas.

Sbordone (2005 [18]) made it clear in more detail that there are five categories of environmental actions to be considered in a path of urban sustainability: the control of pathogens

and care of urban hygiene, reduction of physical and chemical risks in homes and workplaces, promotion of a better quality of life, with the presence of widespread green areas equipped, the recovery of cultural heritage that represent the memory of the city, ensuring progress and the achievement of human needs without affecting the environmental capital.

This type of analysis focuses on the ability to identify particular territorial conditions, such as the presence of a specific type of institutions, economic actors, social elements, or historical conditions that may determine a particular development of sustainability (Coenen, Benneworth, Truffer, 2012 [8]). The formation of workshops, able to generate debates between groups of citizens and stakeholders, is the fundamental tool to facilitate the start for the formation of a future vision through the phases of analysis of the existing and evaluation until the realization of the sustainable city (Nevens, Frantzeskaki, Gorissen, Loorbach, 2013 [16]).

The danger at this stage is to consider urban sustainability as a system aimed at improving the economic efficiency of the city, clearly very attractive to the current capitalist system. This could generate a lack of capacity to address environmental issues fully and completely exclude social ones. Instead, the goal is to rebuild an efficient relationship between society and the natural environment, aiming at environmental justice and enhancing the movements that promote this issue (Cook, Swyngedouw, 2012 [9]).

Therefore, the spaces of sustainability are the result of the interaction of environmental, economic, and social issues. From an applicative point of view, they allow designing urban landscapes that, on the one hand, are inserted in

⁴ Duvigneaud was the first who described the city as an ecosystem by studying the ecological factors that characterize it: "topography, hydrography, climate, soil

factors, non-human biocenosis and anthropocenosis, i.e. the part determined by human presence" (Alberti, Solera, Tsetsi, 1994 [1]).

the socio-cultural context and, on the other one, revalue natural elements. An attempt at the urban level to achieve this goal is represented by *Landscape Urbanism* (Tononi, 2015 [22]). Based on human-nature interaction, a quality landscape can quickly express the correct application of the principles of sustainability. In this regard, geography has a crucial role in contributing to the attempt to integrate these two elements in planning. It is no coincidence that the concept of urban landscape can introduce natural, cultural, and historical elements within a design that tends to sustainability and enhance urban greenery (Breda, Zerbi, 2013 [4]).

In this phase of transition, the role of Environmental Education is fundamental and represents the instrument capable of transmitting to citizens correct behaviors and new lifestyles compatible with the protection of the environment. This article aims to propose some reflections on the importance of environmental education in sustainable city building processes.

Methods

From the methodological point of view, the contribution is divided into three parts. The first deals, albeit briefly, with the meaning and role of Environmental Education indicating the goals and operational tools. The second illustrates the origin of the concept of sustainable cities. Finally, two case studies of European cities that have successfully launched a righteous path towards sustainability will be exposed. In these cases, Environmental Education has played a leading role. The selection criteria for the case studies are the list of cities awarded the “European Green Capital” award. In an entirely homogeneous way, we chose among the cities that have sustainability as a primary objective in their development programs. As the northern European cities are the ones that have won the title several times, only while the central-southern quadrant has been selected in the current study. Only four cities: Vitoria-Gasteiz (Spain), Nantes (France), Ljubljana (Slovenia), and Lisbon (Portugal) won

Table 1

**The list of cities that obtained the European Green Capital Award.
Bold the cities selected in the study**

Cities	European Green Capital Award (year)
Stockholm	2010
Hamburg	2011
Vitoria-Gasteiz	2012
Nantes	2013
Copenhagen	2014
Bristol	2015
Ljubljana	2016
Essen	2017
Nijmegen	2018
Oslo	2019
Lisbon	2020

the European Green Capital Award in 2012, 2013, 2016, and 2020, respectively⁵.

The choice of the two case studies fell on Nantes 2013 (France) and Lisbon 2020. The reasons for this choice were essentially two: firstly, they housed more than 300,000 inhabitants, and secondly, they underlie clear political choices. Nantes has shown a more “social” dimension, while Lisbon has instead privileged the environmental aspect. Importantly, both cities demonstrated a primary role of environmental education.

Results

3.1 *Nantes* – The city had a flourishing industrial past. A substantial decline phase followed this due to deindustrialization, relocations, and the loss of importance of its port. During the years, thanks to a robust public impulse, a new phase of urban renewal began by improving the contact with the natural environment. In particular, with the river, the Loire, which flows through it (Chassériau, 2004 [6]). In the Sustainability Report drawn up annually by the public administration, the objectives and indicators chosen to implement its sustainability paths are indicated from time to time. The French city has chosen to pursue a development that tries to reconcile environmental protection, economic development, and social cohesion. The strategy of Nantes has an exclusively social character, including the increased attention to the housing problem (in recent years, there has been an increase in social housing buildings that now reach 25 % of total housing), the improvement of the quality of urban life, based on the increased accessibility of

services, environmental health and finally the active participation of citizens on future community choices. The second point concerns new forms of solidarity and, in particular, access to public services, living together, awareness of legality, diversity, the fight against prejudice, and cooperation with other cities around the world. Only the third objective introduces the environmental component, with the challenge of climate change, focusing more on reducing energy consumption by 20 % of municipal buildings and lowering CO_2 production by affecting transport modes. The fourth point deals with biodiversity and how to reintroduce nature in the city through gardening in collective spaces, reducing the use of plant protection products, and promoting environmental education in schools. The latter aspect, because of the importance given to the social component of sustainability, takes on particular significance. Students are invited to follow an educational path based on respect for the environment and the preservation of biodiversity, so much so that only organic food products are used in school canteens. In the last part of the report, we return to the public services offered to citizens, and we take as an example of the growth of organic products in school canteens,

The imprint that emerges from these relationships is attention to the social component, cohesion, and accessibility. Nantes cares about the disabled in its sustainability policies, obtaining awards both at national and European levels, such as the *Access city award*⁶. The participation, involvement, and education of citizens play a central role in achieving the objectives. *Ville domain*⁷ is a project of involvement in transforming the metropolitan city

⁵ European Commission. European Green Capital Award. URL: <https://ec.europa.eu/environment/europeangreencapital>

⁶ European Commission. Employment, Social Affairs & Inclusion. Social protection & social inclusion. Persons

with disabilities. URL: http://ec.europa.eu/justice/discrimination/disabilities/award/index_en.htm

⁷ Agence d'Urbanisme de la Région Nantaise. URL: www.mavilledemain.fr

of Nantes and participatory sustainable development. However, it must be taken into account that the regeneration of large areas of the city can generate *gentrification* (Rossi, Vanolo, 2010), not realizing the willingness of urban policies to focus on the social component, often outclassed by economic priorities. The path towards a sustainable city faces practical implementation difficulties in bringing together the various actors involved and mediating between the various aspects of regeneration projects, both technical and economic, in the French city (Dumont, Andrieu, 2006 [12]).

3.2 Lisbon – In recent decades, the Lusitanian capital has improved its image, so much as that it is one of the most significant destinations of European urban tourism. Since 11 January 2020, the city of Lisbon has been the European Green Capital. As one can learn from the event's official program, the bid was based on four different axes of development⁸. The first concerns the concrete response to climate change by lowering *CO*₂ production, acting on various aspects, such as energy-saving, energy efficiency, renewable energy sources, and sustainable mobility. The second axis concerns the actions that most directly address the improvement of mobility. The program has planned to increase soft mobility, encourage pedestrianization of some areas, construct new bike paths, and improve the public transport network to reduce *CO*₂ emissions to reduce the greenhouse effect response to all international programs. In this context, further actions aimed at improving public green areas are planned, with planting new trees and establishing urban gardens to be located in

marginal areas. The fourth axis of development includes actions aimed at improving urban hygiene. It is based on three fundamental points: the underground arrangement of waste collection containers, a further push to separate waste collection, and finally, the implementation of correct policies for the start-up of the circular economy. Also, the treatment of all wastewater for watering public greenery and street washing, and finally, the completion of the Tagus River's clean-up has been carried out. This aspect also includes important rainwater drainage works because of the worsening of extreme climatic events, which, given the orography of the city, can easily create floods and landslides. The third axis concerns the city's energy efficiency; in fact, the old street lighting and public buildings have been replaced by low consumption LED lamps and a substantial increase in solar energy production. All these actions have been accompanied by engaging environmental education activities, which are based on the production of explanatory brochures and school activities aimed at school children⁹.

Discussion and conclusions

From the comparison of the illustrated case studies, two conclusive aspects can be drawn: The first one concerns the flexibility of the concept of urban sustainability. This flexibility has often been seen as a weakness, far from a rigid scheme to be applied. The second fundamental aspect is the promotion of environmental quality. Environmental education has its primary objective in leading all individuals to understand the complexity of the environment, both natural and human. This complexity derives from the

⁸ The program is full of public initiatives, with thematic exhibitions, conferences, ecological walks in city parks, creative activities of environmental education. Unfortunately we are not able, as a result of the known anti-COVID-19 limitations, how many of these

initiatives have actually been carried out and whether the program has been reduced.

⁹ LISBOA. URL: <https://www.lisboa.pt/cidade/ambiente/qualidade-ambiental/recursos-pedagogicos>

interaction of its biological, physical, social, economic, and cultural aspects, and the acquisition of cognitions, values, behaviors, and practical and indispensable skills to participate responsibly and effectively in the prevention and solution of environmental problems and management of environmental quality, as was established in the Declaration of Tbilisi in 1977. What emerges is that environmental education aims to develop citizens' knowledge and actions to distinguish and observe the various aspects of the environment to know the characteristics and understand more deeply the different ways to safeguard environmental resources.

The protection and development models can only be designed and implemented if they are based on a correct knowledge of the environmental context and the cultural centers that organize and modify it. This presupposes considering environmental education from an interdisciplinary perspective, justified precisely by the object of the study's complexity, the environment. It should also be emphasized that environmental education is not limited to transmitting information, to raise awareness of citizens to spread knowledge; it aims primarily to change habits and behaviors, to build a correct and forward-looking relationship between man and the environment. Therefore, it is a question of acquiring a new culture of the environment based on prevention, recovery, protection, and correct management choices. Environmental Education

must then link two educational objectives: promotion of awareness of environmental problems and developing operational skills, such as a sense of initiative and the ability to assume and take responsibility.

For this reason, not only school, as a primary agency, but also voluntary associations can make a valuable contribution. Indeed, the associations see the community as a protagonist and, therefore, a target of various actions to promote environmental education. In the voluntary activity, supported by a robust ethical involvement and spontaneous action, there is often an emotional component that exerts, therefore, an easy-grip on public opinion. However, in the case of the two cities in question, it was precisely this aspect that was a focal point and a strength. In other words, if the community wants to start a project of sustainability, its decisions will be discussed and confronted between the parties. After that, it will be adapted to the different needs of the territory. The comparison of conflicting visions is the main feature of creating a sustainability strategy that can then have a shared and successful path. The second concerns environmental education actions, which represent the core of every initiative. Moreover, all the primary international documents on environmental protection emphasize the need for it.

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Экологическое образование и его вклад в развитие устойчивых городов

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Проблема и цель. В 2050 г. численность населения на планете достигнет 9,7 млрд человек, из них более 5 млрд будут проживать в городах. Антропогенное давление на природные экосистемы постепенно увеличивалось и достигло тревожного уровня с серьезными экономическими и социальными последствиями. С экологической точки зрения города выступают как гетеротрофная система. Они импортируют сырье, перерабатывают его и утилизируют отходы, в основном в местах, обычно очень далеких от них. Таким образом, город представляет собой неуравновешенную систему, нуждающуюся во все большем количестве функциональных сельских пространств для поиска ресурсов, необходимых для дальнейшего развития и прогресса. В статье подчеркивается важность экологического образования в процессах устойчивого городского строительства в городах Южной Европы.

Методология. Поскольку Европейский союз активизировал свое участие в устойчивых городах, в исследование были включены только те города, которые отмечены наградами европейских зеленых столиц. Города Северной Европы были исключены, поскольку экологическое образование в них было разработано ранее. Методология, используемая в данном анализе, – это исследование случая.

Результаты. Экологическое образование – это процесс, который позволяет людям узнать об экологических проблемах, решить проблемы и предпринять действия, чтобы помочь окружающей среде. В анализ были включены два города: Нант и Лиссабон. Стратегия Нанта заключается в том, чтобы привлечь внимание к жилищной проблеме, улучшить качество жизни в городах и активность участия граждан в выборе будущего сообщества. Лиссабон планирует увеличить «мягкую» мобильность, построить новые велосипедные дорожки и улучшить сеть общественного транспорта.

Финансирование проекта: Исследование выполнено в рамках проекта Модуля Европейского союза Жана Моне «Повышение квалификации и компетенций в европейских исследованиях для ландшафтных архитекторов, специалистов по охране окружающей среды и менеджеров».

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Заключение. Анализ двух городов, проведенный с помощью сравнительной методологии, показывает потенциальные области вмешательства и указывает, как экологическое образование способствует устойчивому развитию города. Вместе Нант и Лиссабон применили стратегию экологического образования, основанную на участии, вовлечении и просвещении граждан. Аналогичные стратегии рекомендуются для будущего развития более устойчивых городов.

Экологическое образование вносит вклад в устойчивое развитие города, способствуя осознанию людьми экологических проблем. В то же время оно стимулирует рост оперативных навыков, таких как чувство инициативы и способность брать на себя и нести ответственность.

Ключевые слова: экосистема; устойчивость; устойчивый город; образование; окружающая среда; Европа; Европейский союз.

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