

## Article

# Education for Sustainable Development in Educating Cities: Towards a Transformative Approach from Informal and Non-Formal Education

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**Abstract:** This paper summarizes the main findings of research on education for sustainable development (ESD) at the international level. The context of the research regards educating cities, or local administrations committed to education through all their policies with the purpose of transforming their territories through a human rights approach. The research's goal is to explore to what extent educating cities are capable of coping with the three ESD challenges faced today: the gap between policy and practice, the lack of a transformative approach and the hegemony of formal education. To do so, we selected three educating cities with an important background on ESD—Barcelona, Changwon and Rosario—and we implemented a case study method. A detailed analysis of all the data obtained reveals that educating cities are suitable frameworks to overcome the current ESD challenges. Their ESD initiatives count on a significant impact on citizenship, by promoting interdisciplinary, intersectorial and participatory processes mainly in informal education settings. Further research needs to be developed in order to draw a broader analysis.

**Keywords:** sustainable development; education for sustainable development; educating cities; non-formal education; informal education; Local Agenda 21; sustainable development goals



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## 1. Introduction

Sustainable development is one of the great current challenges of humanity. It arises as an alternative to a reductionist conception of development understood as economic growth, and proposes to reverse the risks of a production system based on the unlimited depredation of natural resources and a system of human relations based on the unequal distribution of goods and care, necessary to continue sustaining life [1].

Sustainable development is an organizing principle of human development that aims to guarantee a balance between, on the one hand, the long term needs of humanity, and on the other, the capacity of natural systems to provide resources and services on which the economy and society depend [2]. Sustainable development proposes responses to the challenges arising from three large development-related dimensions that are also interrelated—the three “Ps”: an environmental dimension (planet), an economic dimension (prosperity) and a social dimension (people). Recently, however, this approach has been expanded with two additional “Ps”: an ethical dimension (peace) and an organizational dimension (partnership) [3]. These last two dimensions are of great importance in the present, and emphasize the necessary solidarity between all human beings (regardless of their generation) and all living beings in general [4].

At the international level, the political agreement for sustainable development is marked by three milestones: the 1987 United Nations Conference on Environment and Development and its Brundtland Report, which conceptualizes sustainable development; the 1992 Rio de Janeiro Earth Summit and its Agenda 21, which operationalizes its implementation; and the 2015 United Nations Summit on Sustainable Development, which globalises sustainable development as a global priority through the 2030 Agenda and its 17 goals [3].

Such an ambitious policy requires the commitment of all social actors and their agency capacities to achieve its objectives, and the education sector is one of the most strategic if they are to be achieved. The relationship between education and sustainability is bidirectional: sustainability must be an essential content of education, and education must be a privileged social space to train for attitudes and practices consistent with sustainable living [5]. This is where education for sustainable development (ESD) arises, an education with an integrative approach that calls for a change in the educational paradigm, instead of being just another adjective for education such as environmental education, and an education that promotes learning about the balance between economic, environmental and social factors, making a clear reference to the three pillars [6].

There are different models of ESD. Shohel et al. [7] provide us with a triple classification: education *on* sustainable development, which provides awareness that generates changes initially in attitude and then in behavior; education for sustainable development, which focuses on actions that change attitudes and raise awareness to develop a lifelong sustainable practice; and critical education towards sustainable development, which emphasizes the generation of knowledge through critical action and the development of a critical and active citizen attitude. Barth et al. [5] propose another triple classification: education on sustainability, which simply transmits factual information about concepts and processes around sustainability; education in sustainability, which uses experiential and interactive learning processes to generate a more global understanding; and education for sustainability, focused on a more transformative approach to education that facilitates the adoption of the principles, ethics and values of sustainability.

Both classifications coincide with the characteristics of an advanced model of ESD, both in content and methodology as well as the context of action. Regarding the content of ESD, the need to focus on attitudes, practices and values is stressed. The reason for this is simple: the cognitive effect reminds us that an increase in theoretical knowledge about sustainability does not necessarily imply a tangible change in everyday life, so it is recommended to focus on the real behavior of people from a competency approach [8].

Regarding the methodology, both identify the transformative approach as optimal, since this approach facilitates better than any other a construction of beliefs, values and practices compatible with a more responsible lifestyle in a social and ecological approach. A transformative methodology is based on an experiential learning pedagogy, capable of incorporating the socio-emotional dimension of learning [9] and generating profound and long-term impacts in the communities where it is implemented.

Finally, in relation to the context of action, there are many authors who warn of the insufficiencies of formal education to carry out an education for transformative sustainable development. The school has less critical potential than other educational scenarios, limited by the pressures of public powers and the economic world to alienate it socially, and to align it with the productive forces at the service of the market [10]. For this reason, non-formal and informal education contexts emerge as powerful alternatives [5,9,11–13].

At the international level, ESD has been growing on the political agenda in an integrated way along with sustainable development. Over the last few decades, public policy has also been concerned with designing objectives, a roadmap and a framework for action in this regard. At the 1992 Earth Summit in Rio de Janeiro, chapter 36 of Agenda 21 establishes that societies must move towards sustainable development through education, understood as key, and it recommends an increase in opportunities to overcome practices of unsustainability and promote quality of life throughout the planet [3].

UNESCO is an essential actor in this deployment. It has to its credit the organization and monitoring of the Decade of Education for Sustainable Development 2005–2014. This decade unfolded in two phases: a first phase dedicated to defining and promoting education for sustainable development through the identification of actors and the establishment of partnerships (2005–2008), and a second phase focused on promoting a renewed advance of its concept and practice, with a special focus on three key issues: climate change, biodiversity and risk reduction associated with catastrophes (2009–2014) [3]. Its mission is to facilitate the processes of transforming mentalities towards sustainable development [14].

After this decade, ESD found its definitive fit in public policy in the aforementioned 2030 Agenda for Sustainable Development [15]. In this Agenda, education in general is given a fundamental role: progress in Objective 4 of education has direct impact when it comes to achieving sustainable economic growth (Objective 8), the construction of resilient infrastructures and innovation (Objective 9), responsible consumption and production (Objective 12) and the creation of strategic alliances (Objective 17) [16]. In addition, ESD appears explicitly in Objective 4.7. This section insists on the competence approach and underlines the strategic role played by non-formal and informal education to carry it out. In this framework, ESD appears closely linked to education for global citizenship, although we must point out that it is an asymmetric relationship: while education for global citizenship clearly incorporates ESD in its approach, the same does not happen in reverse with similar intensity [17]. Be that as it may, the Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development measures in a single indicator the degree to which education for global citizenship and ESD are incorporated into national education policies, study plans, teacher training and student assessments, [18] and everything points to the need to carry out an integrative approach between one and the other.

We wish to highlight the importance given to the local level for the implementation of transformative ESD. If sustainable development requires a multilevel public policy intervention, so too does the education related to it [3]. It makes sense that the local context, and cities in particular, are privileged spaces to carry out ESD. Cities host the largest habitat of dominant species on the planet and place great demands on the ecosystem. Understanding the ecology and organization of cities, as well as their dependency relationships with the natural environment, is a fundamental challenge in the study of sustainability [19].

We agree with United Cities and Local Governments (UCLG) that cities are the key context in which real transformations that directly impact people's wellbeing and quality of life take place. It is at the local level, increasingly urbanized, where the interactions between the different agendas take place, and where inclusion and sustainable use of natural resources can be largely promoted [20]. It is the local authorities, in open dialogue with the citizens, who can develop a Local Agenda 21 that mobilizes all local actors in the search for sustainable solutions to their urban problems, supported by an education in transformative sustainable development based on a sociocritical paradigm [21].

International documents on ESD explicitly point to the local context as a privileged space in which to carry this out. The 2015–2019 Global Action Program, derived from the 2005–2014 UNESCO Decade, focused on ESD. It points out public policies, educational institutions and programs, the training of educators and youth activism as spaces of key incidence, with a special accent placed on the local world [22].

Education plays a fundamental role in the development of this local strategy, because there is a relationship between quality education and an improvement in the quality of the environment [23]. A quality education is what facilitates, among other things, citizens acquiring the basic skills for the transition to organic farming or industrial production based on green technology, from a productivity point of view [24], and the incorporation of the responsible use of water and energy to build more sustainable cities [25].

The international organizations that group cities committed to SDG 4 (education for global citizenship, education for sustainable development, education throughout life) incorporate ESD as a central element in their declarations and plans of action. This is

the case for the UNESCO Global Network of Learning Cities, which prioritizes SDG 4 (education) and SDG 11 (sustainability) as central axes of action [26]. It is also the case for the International Association of Educating Cities (IAEC), which in its founding charter warns of the current profound eco-social crisis, underlines the eco-dependent condition of human life and the physical limits of the planet and promotes the adoption of fair, resilient and sustainable living and consumption styles, under the principles of sufficiency, distribution and justice [27].

Both organizations agree on two fundamental aspects. First is the need for an education that places the meaning of the 2030 Agenda—democracy, sustainability, justice and care—in a shared framework of action between education for global citizenship and ESD [28], as commented above. The intersection between global citizenship and sustainability lies in the social pillar of sustainability, which emphasizes issues such as migration, social inclusion, social justice and human rights [6]. Acting as a citizen of a sustainable society is not something that is given, but something that is learned, and this learning must allow for the establishment of a fruitful relationship between citizens and decision-making processes with content of public interest [29]. Second is enhancing the value of non-formal and informal education, as already mentioned, since these typologies provide a flexibility and a sense of community that formal education cannot fully satisfy.

This article focuses on the IAEC in particular, and how this international organization proposes action frameworks for its cities to overcome the three main challenges that hinder transformative ESD:

- The existing gap between public policies for sustainability and their substantial impact on social reality [30].
- A technological approach to competencies, methods and institutional contexts [5].
- Emphasis on formal education to the detriment of non-formal and informal education [13].

## 2. Materials and Methods

### 2.1. Case Study Approach

The aim of this research has been to identify models and trends among the public education policies for the sustainable development of the cities of the IAEC. This is a study that fills a gap in the international research literature and that responds to the need already expressed by some authors to develop more research on sustainability in the local sphere, in order to better understand the impact of local decisions on a broader scale [31].

The design of this research has been based on the case study method. The choice of said method, as well as its characterization, responds to different criteria. Starting from the systematic review of different authors (Ragin and Becker, Stake, Yin) [32], we have established that:

- Our case study should be understood as an empirical unit of a specific nature, as opposed to other, more theoretical or general modalities. This is due to the fact that our objects of study are local public policies to promote ESD that are in operation in a specific context.
- Our case study is designed holistically and is multiple. We are interested in observing various formats of public education policies for sustainable development used by cities. We are interested in an approach based on its global nature and general impact on citizens, and we need to select more than one case for study because this highlights the importance of the diversity of contexts in applying shared public policy principles, increases the epistemological value of the results that can be obtained from the comparison between the emerging data and allows the researcher to analyze the data under one circumstance and through various situations [33].
- The nature of our case study is descriptive, compared to other, more exploratory or explanatory options.
- The case study allows us to understand knowledge from experience. We do not intend to generalize the information obtained from the analysis of public policies, nor to predict phenomena, but to understand real phenomena in a specific context [34].

- The case study is one of the most considered methods in the investigation of organizational phenomena [35].

## 2.2. Sample Selection

The selection of the three case studies has been carried out by searching for paradigmatic cases, compared to other types of cases such as extreme, maximum variation or critical cases [36]. The selection process has been carried out through intentional sampling based on an assessment carried out by a mixed team made up of academics and those responsible for the IAEC secretariat. This assessment was based on the following criteria, according to the research objective: degree of experience as an educating city, geographic diversity, size, degree of political priority, public investment and number of public policies in operation.

The evaluation has considered identifying cities that have a minimum experience of 15 years in the development of the educating city model, are representative of a geographical diversity that facilitates the identification of common principles, that are of a size close to one million inhabitants—large enough to implement impact strategies, and small enough to measure tangible signs of change—with a high degree of priority in sustainability policies and investment in actions, which participate in a transformative approach to ESD and that have a number of policies in excess of 10.

The application of these criteria to a population of 501 cities belonging to the AICE has led to the selection of three of them for the configuration of the sample. In the following Table 1 we offer the matrix of the sample with the selected cities:

**Table 1.** General characteristics of the selected cases. Source: own elaboration.

	Barcelona	Changwon	Rosario
Year of enrolment in IAEC	1990	2006	1996
Geography	Europe	Asia	America
Population	1.6 M.	1.0 M.	0.9 M.
Priority level of SD	High	High	High
Public investment in SD	High	High	High
Number of programs on ESD	>10	>10	>10

Spatial and cultural divergence favors the identification of generalizable common principles, and convergence in demographic, political, economic and pedagogical characteristics favors the consistency of the data obtained.

## 2.3. Collection and Analysis of Information

The data collection process has been carried out based on an information search process that responded to criteria of relevance and pertinence in clear consistency with the objective of the study. The information obtained and systematized in provisional reports for each case has emerged from documentary analysis, participant observation and interviews with key actors. The data collection criteria were based on the keywords “sustainable development”, “education for sustainable development” and/or “sustainability”, and was carried out between September and November 2021. Once the process of information collection has been completed, 40 plans, programs or projects on ESD, or on sustainable development with ESD strongly embedded, were identified (Barcelona, 13; Changwon, 12; Rosario, 15).

We have based the analysis of the information collected on retroductive reasoning [34]. Said reasoning combines inductive and deductive reasoning as complementary but not exclusive elements, and allows us to strengthen the validity and reliability of the data when there are only a few case studies. On the one hand, inductive reasoning allows models and theories to be built from the data obtained. The constant comparison method, by identifying units of meaning with codes that are subjected to permanent contrast, gives rise to explanatory categories that are related to each other, and this leads to consistent results [12,37]. On the other hand, we have developed a deductive reasoning method based

on pre-established categories that arise from the literature review, and that correspond to the research goal. Thus, as codes and categories have emerged, we have developed a constant comparison process within the framework of a matrix of qualitative data (see Appendix A). Let us see below what these categories have been, based on the three major analysis challenges.

In the first place, to respond to the challenge of the existing gap between public policies and social reality, we have developed some categories of analysis based on an ad hoc adaptation of the 6i model [29]. Said analysis criteria are the following, on the basis that the more criteria a public policy reflects, the stronger its relationship with the social reality to which it corresponds:

- Import (I1): a plan, program or project will be more relevant and pertinent than another if it has more potential for transferability to another context.
- Interdisciplinarity (I2): a plan, program or project will be more relevant and pertinent than another if it combines diverse knowledge and conceptual frameworks.
- Intersectoriality (I3): a plan, program or project will be more relevant and pertinent than another if it implies the joint participation of different social actors.
- Impact (I4): a plan, program or project will be more relevant and pertinent than another if its actions are sustained over time.
- Innovation (I5): a plan, program or project will be more relevant and pertinent than another if it introduces new solution formats to emerging problems.
- Inclusion (I6): a plan, program or project will be more relevant and pertinent than another if it involves a wide diversity of participant identities.

Secondly, to analyze the transformative nature—or lack thereof—of public policy, we have paid attention to the key factors of Local Agenda 21 [4]:

- citizen participation (T1)
- associationism in networks (T2)
- systemic approach in action planning (T3)
- political and social consensus in decisions (T4)
- global reference for local development (T5)
- permanent dialogical interaction through democratic processes of confrontation and consensus (T6)

Thus, we can affirm that the more factors are found in the plans, programs and projects of the selected public policies, the greater will be their transformative nature. Faced with positivist, eco-development or systemic approaches, we also share with Aznar Minguet [4] that the transformative approach to policies is the most appropriate in a world marked by diversity, mobility and complexity, dimensions that allow us to understand the environmental challenges in a dynamic, relational, communicative, transformative and autopoietic key.

Finally, to respond to the third challenge—the importance of non-formal and informal education—we propose to analyze which of these is the dominant educational typology in the selected public policy: formal (F1), non-formal (F2) and informal (F3). According to some of UNESCO's definitions:

- Formal education is the education that is institutionalized, intentional and planned through public organizations and recognized private bodies and—in their totality—constitute the formal education system of a country [38].
- Non-formal education includes all organized educational activities for adults and out-of-school youth in some countries. Non-formal education is the flexible middle between formal education and informal learning, which are more strictly operationalized as dichotomous [39].
- Informal learning is never organized, is non-institutional and has no established objective in terms of learning outcomes—it is also not directed by the learner. The individual's existence predicates exposure to learning situations throughout the spaces

in society they travel and occupy, such as work and home, community activities and through leisure time [39].

### 3. Results

#### 3.1. Gap between Public Policies and Impact on Social Reality

The three cases are good examples of how to minimize the gap between ESD public policies and social reality. Below, we highlight the main results according to the analysis variables for this challenge: transferability/importation, interdisciplinarity, intersectorality, impact, innovation and inclusion.

Transferability has little presence in most of the ESD public policies. Barcelona is the city where this variable is more reflected within its plans, programs and projects, and even so it is only present in half of them. A detailed analysis of the data allows us to state that there is a strong localization of ESD in the three cases, with little transferable potential. In the case of Changwon, transferable programs and projects are closely related to formal education, and in particular to classroom activity, such as the Children's Dream Tree Environment Class or the Environment Experiential Learning for 3rd Graders in Primary Schools. In Rosario and Barcelona, transferability is linked to institutions that promote ESD (for example, the Climate Action Centre from Rosario), acting as nodes for disseminating good practices and promoting communities of learners, as well as to the institutionalization of sustainability in formal education, through programs such as Rosario's Climate Action Schools or Barcelona's Sustainable Schools Program.

Interdisciplinarity takes a better place in ESD public policies. There are two areas where interdisciplinarity arises the most. First is the institutional declarations and political frameworks of the local strategy towards sustainable development. ESD is a valuable content of Changwon's 2030 Smart Climate Environment City, Rosario's 2030 Climate Change Local Plan, and the Barcelona Sustainability Agreement. Education is interrelated with other topics and disciplines such as the use of resources and waste control, air and water pollution, urban mobility or the fair distribution of goods and care. The second is non-formal education initiatives devoted to reflection and dialogue around sustainability, with the BCN Youth Forum or the Changwon Environmental Forum being good examples of that. Interdisciplinarity is developed in a framework of strong citizen participation, and generates social impacts from an informal perspective of education.

The three cities agree to make both intersectionality and impact the core of their ESD policies. All the ESD plans, programs and projects are designed, implemented and evaluated by a large and diverse number of stakeholders. ESD is not just a mission for educators, but also for research centers, economic and cultural institutions, civic associations and citizens on their own. An intersectional and impacting framework guarantees that the gap between ESD public policies and social reality tends to zero, since the main stakeholders are strongly committed to the ESD's aim and strategy. Some good examples are Changwon's Regional Centre of Expertise on Education, Rosario's Urban Agriculture Program or Barcelona's Superblock Program. These are long-term plans, programs or projects, some of them having been implemented for more than two decades, and are well known by the population—clear indicators of a deep social impact. The three cities show a solid pathway for ESD implementation to be satisfying among citizens, although further research is needed to determine whether ESD has or has not always been as transformative as it is today.

Innovation is also a relevant variable of ESD public policies. Barcelona stands out in particular, with programs such as the 2030 Inclusive Playgrounds Plan (for the redesign of public playgrounds in order to include criteria of sustainability and inclusiveness), or the Climate Shelter Schools. Rosario also stands out with the Urban Agriculture Program or the Waterfront Redevelopment Plan. In all cases, these programs are long-term urban initiatives that integrate innovative aspects based on a citizen's perspective, and they all have a direct informal educational impact on the population. We also realize that innovation should not necessarily be linked to novelty. Although some of the programs have been working

for more than two decades, we also observe a capacity for them to reinvent and update themselves. This is especially remarkable in some pioneering projects aimed at formal education: the Changwon Environment Experiential Learning for 3rd Graders in Primary Schools, the Climate Action Schools in Rosario or the Sustainable Schools Program in Barcelona. In all these three cases, these initiatives have evolved according to the changes that have taken place in society: increases in climate change's negative effects or the introduction of ICTs in teaching, among others.

Finally, inclusion draws a low profile in ESD public policies. Most of the plans, programs and projects are addressed to a general audience, with no specificities regarding special needs. We just see a few experiences that really take inclusion into account. Two different approaches arise from the analysis: the first are proposals to meet the needs of economically disadvantaged groups in a sustainable way—the Changwon Goods Provision initiative of the Hope Project, aimed at satisfying the basic needs of the Cambodian population according to sustainable criteria, or the Rosario Rosario's Green Outskirts, aimed at promoting vegetables gardening made by citizens at socioeconomic risk and the consumption of eco-friendly products. The second is proposals addressed to young people. We highlight the BASURATON Youth Action in Rosario or the Adolescents Participation Process in Barcelona. We identify both the social and economic pillars of sustainability in all these programs.

### 3.2. *A technological Approach to Competencies, Methods and Institutional Contexts*

We agree that a technological approach to ESD reduces its transformative potential, since the activities may suffer from a cognitive effect. Therefore, we need to observe to what extent our three cases respond to conditions that make a transformative approach viable: citizen participation, networking, a systemic approach, political and social consensus, global references for local development and dialogical interaction. We have found enough evidence to state that the three cities are a good example of local public policies that promote a transformative ESD. We summarize this evidence in the following paragraphs.

Citizen participation appears as the most remarkable condition of the ESD policies in the three cities. Active participation is one of the essential ingredients of all the programs. It seems clear that the educating cities run ESD by empowering citizens and opening spaces for deliberation and action. However, the participation levels show significant differences depending on the context. The participatory processes in Changwon's ESD programs shape participation at low levels: information or consultation (see everything related to the Junam Reservoir Wetland). Citizens enjoy ESD activities as users. In the case of Barcelona, the participation levels are higher: consultation, delegation or co-decision. Citizens are active both in the design as well as the implementation of some proposals, although the local authorities still play a substantial role, mainly on decision making, resources management or monitoring and assessment (see the Barcelona Superblock Program or the 2030 Inclusive Playgrounds Plan). Rosario shows the highest participation levels: co-management or self-management. Some of the projects even arise from the citizens themselves, and the local authorities play a secondary role. Even citizens organize themselves to make legislative proposals, such as the Wetland Participatory Initiative.

Networking is also a common trend of the ESD programs, although less intensely than citizen participation. All the ESD programs that promote networking show high citizen participation, but not all initiatives that promote citizen participation involve networking. Participation seems to be addressed to more individual than institutional processes, mainly in Changwon.

Both the systemic approach and the global references for local development belong to the programs in the three educating cities. The three pillars of sustainability (environmental, social and economic) are integrated within these programs, and this feature is consistent with the high levels of interdisciplinarity and intersectorality already found. Systemic approaches and global references for local development are mostly present in general public policy instruments: Changwon's 2030 Smart Climate Environment City, Rosario's



2030 Climate Change Local Plan and the Barcelona Sustainability Agreement. They also look relevant in some specific actions with a direct impact on citizens, especially in the field of formal education (the Climate Action Schools in Rosario or the Sustainable Schools Program in Barcelona). A systemic approach and a global reference for local development do not appear when the ESD content is directly related to local biodiversity, such as the Junam Reservoir Wetland in Changwon or several natural spaces in Rosario (Los Constituyentes Forest or the Isla Deliot Wetland Program).

Regarding the political and social consensus and the dialogical interaction among the different stakeholders, we observe that the three educating cities offer good examples of public policy developed under those principles. None of the three educating cities would have achieved the outcomes described if they had not embedded a strong political and social consensus in the ESD processes. The sustainable development declarations are a good example of this. Barcelona, Changwon and Rosario developed this consensus through a social dialogue where the different stakeholders had the opportunity to express their opinion, participate in decision making, and be protagonists in carrying out some activities. However, the comparative analysis let us show some slight differences among the three cases concerning dialogic interaction: in Changwon, the dialogic interaction is more oriented towards reflection and cognitive learning, whereas in Barcelona and Rosario, dialogic interaction is more oriented towards transformative action and critical thinking.

### *3.3. Emphasis on Formal Education to the Detriment of Non-Formal and Informal Education*

We have found enough evidence that the three educating cities are also a good example of how to promote ESD beyond formal education. To analyze the educational contexts where ESD takes place, we need to address two preliminary questions. The first is the administrative structure (centralized–decentralized) and the distribution of educational competences in each city (national level–local level). In this case, our three educating cities belong to countries with a centralized model of educational policies: the educational competences in formal education are mostly located at the national level, and local levels are limited to manage non-formal and informal education programs. These programs do not monitor the education of the city, but rather support education in the city.

The second preliminary question is about the educational framework. As we read in the literature review, there is an international trend to increase the non-formal and informal education programs, and to shape formal education to make it less rigid. ESD also follows these trends, and we need to understand the latest developments according to this broader framework.

We have proceeded to analysis by considering both preliminary questions, and the evidence is strong: the three educating cities mostly promote ESD through an informal education context. The general sustainable development policies show a strong educational dimension. Barcelona, Changwon and Rosario plan their sustainable development programs by creating spaces and conditions for citizens to learn attitudes, values and practices of sustainability through indirect intervention. The expected outcomes are intangible and achieved over the long term: it is not the intention to change people's negative attitudes about sustainability with direct intervention programs, but to create smart physical and social environments to make people change through critical thinking experiences. The Weekend Environment Experience Program in Changwon, the Vegetable Gardening Programme in Rosario and the Barcelona Superblock Programme follow this path.

The predominance of informal education through indirect intervention does not mean that non-formal education programs might not exist. We can also identify relevant non-formal education programs, and they are basically devoted to social groups in vulnerable situations: young people and people at social risk for economic reasons (see the Poble Sec Community Climate Shelters in Barcelona, the Urban Agriculture Program in Rosario, or My Village's Environment Guardians in Changwon). These non-formal education programs are the same that scored high in inclusion as well. Other non-formal education programs aim to introduce a reflexive or artistic component to ESD from a communitarian

perspective, and citizens play an active role in them (see the Changwon Academy, the Youth Cultural Warehouses in Rosario or the BCN Youth Forum).

Finally, the number of ESD programs that the three educating cities offer to schools is limited, due to the reasons previously mentioned. A comparative analysis shows consistent differences among the three cases. In Changwon, the formal education programs run by local authorities are at the classroom level (Environment Experiential Learning for 3rd Graders in Primary Schools). In Rosario, these programs are more concerned about the school level (Climate Action Schools). In Barcelona, the formal education programs by local authorities combine a holistic and comprehensive intervention at the community level together with the school acting as a key stakeholder (Let's Protect the Schools Program). The Barcelona model provides an original and inspiring perspective: formal education institutions generating informal education initiatives for their own community, an example of how to promote more global and comprehensive models of education for all citizens.

#### 4. Discussion

As we can see, the three cases show enough evidence to state that educating cities can be a good framework to face the three great challenges that ESD faces today: the gap between public policies and social reality, finding a technological approach to its action and the predominance of formal education. Barcelona, Changwon and Rosario prove that it is possible to overcome them. The three cities confirm that the local level is a suitable context to make transformative ESD real. Numerous examples certify the powerful role of educating cities to implement the Local Agenda 21 as well as the 2030 SDGs. Their educational policies on sustainability are embedded within the framework of general sustainable development policies and are characterized by an interdisciplinary and intersectorial approach with a strong impact, and with high levels of citizen participation, political consensus and dialogical processes. The priority educational context to carry out these policies in is the informal one, and it goes hand in hand with education for global citizenship.

The three educating cities have been victims of an ecocide similar to any other urban territory in the planet during the 20th century: processes of segregation between citizens and nature, a degraded natural environment and unsustainable urban lifestyles that lead to collapse. Accordingly, these cities have been facing these challenges for more than two decades through a sustainable development policy in which education is essential. However, our comparative analysis allows us to point out differentiated general principles among them. We wish to dedicate some final paragraphs to define some emerging models that come up from the case-study analyses.

Changwon's model is based on the principle of *reconnection* between urban space and its natural environment. Educational programs promote direct contact between citizens and the biodiversity of their own environment. The projects of discovering and enjoying the Junam Reservoir Wetland, and some community experiences about taking care of the natural environment, reflect this principle. The environmental pillar of sustainability is a priority. Educational activities as well as non-formal and informal learning fora are aimed at raising awareness of the value of nature, and of the need to protect it and integrate it with urban life in a balanced way. In terms of Shohel et al. (2011), the role of local authorities is prominent in ESD.

Rosario's model is based on the principle of the *renovation* of urban space. Sustainable development policies adopt a deep educational dimension, and the city carries out an urban transformation to promote public space as a natural space and to foster the development of eco-friendly human activity. The Linear Parks Plan, Rosario's Green Outskirts and all the initiatives addressed to reshape the Paraná River waterfront aim to raise a new awareness of public space as more sustainable, where human mobility gains a new perspective. Local authorities lead these processes together with social stakeholders. However, those ESD programs devoted to sustainable practices of food production and consumption are mainly led by communities themselves. The Urban Agriculture Program, the Food Program or the

Vegetable Gardening Program reflect both the economic and social pillars of sustainability, and their mission is to make citizens competent in the growing of ecologic products and in adopting healthier eating habits. It is an education for sustainable development (Shohel et al., 2011).

Lastly, Barcelona's model is based on the principle of the *reinvention* of urban space, both in its environmental and social dimensions. Due to some evident geographical constraints, Barcelona cannot aspire to introduce principles of reconnection or renovation. The city cannot go further from its perimeter, so it has to recreate the existing physical spaces. Schoolyards, public playgrounds and the surroundings of schools are redefined under a sustainability principle. This reinvention is led by citizens, and some social processes are activated to foster a communitarian sense of belonging and inclusive practices. Barcelona gives a priority to the social pillar of sustainability, and ESD is conceived as a critical education towards sustainable development (Shohel et al., 2011), an opportunity to launch participatory processes with special attention to youth.

Our research has achieved its goals, and we expect that this knowledge might be useful to the scientific community. However, we are also aware of our own limitations. A small number of case studies (only three) significantly reduces the collection of further evidence to reconfirm our findings. Besides, we must also be aware of the intercultural gap produced within international research in analyzing international contexts. It would also be interesting to replicate research with similar characteristics among the UNESCO Global Network of Learning Cities, and observe to what extent the international framework of IAEC is or is not a key element. Nevertheless, the confirmation of educating cities as spaces with a strong potential to carry out transformative ESD is a valuable contribution of this study, encouraging all cities to follow the examples of Barcelona, Changwon and Rosario in this crucial challenge for the survival of humankind, the species and the planet.

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## Appendix A. Matrix of analysis of case-studies

Plan/Programme/Project	I1	I2	I3	I4	I5	I6	T1	T2	T3	T4	T5	T6	F1	F2	F3
CHANGWON															
2030 Smart Climate Environment City		*	*	*	*		*			*	*				*
Changwon Academy		*	*	*	*		*	*	*	*	*	*		*	*
Changwon Environmental Forum		*	*	*			*	*		*		*			*
Changwon-i Piumi Online English Debate Competition	*	*			*		*				*	*	*		
Children's Dream Tree Environment Class	*			*		*					*	*	*		
Environment Experiential Learning for 3rd Graders in Primary Schools				*	*								*		
Migratory Bird Search in Junam Reservoir Wetland				*											*
My Village's Environment Guardians	*				*	*	*	*	*	*	*	*		*	*
Provision of Supplies for Hope Project		*	*	*		*	*	*	*		*				*
Regional Centre of Expertise on Education	*		*	*	*				*	*	*	*		*	*
Wednesday as the Carefree Day of Taking the Bus	*			*											*
Weekend Environment Experience Programme				*	*		*								*
ROSARIO															
2030 Climate Change Local Plan		*	*	*	*		*	*	*	*	*				*
BASURATON Youth Action				*		*	*	*			*				*
Climate Action Centre	*		*	*	*				*	*	*			*	*
Climate Action Schools	*	*	*	*	*	*			*		*	*	*		
Food Programme			*	*		*	*	*	*	*	*				*
Isla Deliot Wetland Programme				*	*		*				*				*
Linear Parks Plan			*	*	*	*	*		*	*					*
Recycling and Reusing Programme	*		*	*	*		*			*	*	*			*
Rosario's Green Outskirts		*	*	*	*	*	*	*	*	*		*			*
The Constituyentes Forest				*	*		*				*				*
Urban Agriculture Programme			*	*	*	*	*	*		*	*	*		*	*
Vegetable Gardening Programme			*	*	*	*	*	*		*	*	*		*	*
Waterfront Redevelopment Plan			*	*	*	*	*			*					*
Wetland Participatory Initiative			*	*	*		*	*	*	*		*			*
Youth Cultural Warehouses		*	*	*	*	*	*	*		*		*		*	*
BARCELONA															
2021 Barcelona World Capital of Sustainable Food	*	*	*				*	*		*	*				*
2030 Inclusive Playgrounds Plan	*		*	*	*	*	*			*					*
Adolescents Participation Process			*		*	*	*	*	*	*		*		*	*
Barcelona Superblock Programme	*		*	*	*	*	*		*	*					*
Barcelona Sustainability Agreement		*	*	*			*	*	*	*	*	*			*
BCN Youth Forum		*	*			*	*	*		*		*		*	*
Climate Shelter Schools		*		*	*	*		*	*	*	*	*	*		*
Community Schoolyards Programme	*					*	*								*
Let's Protect the Schools Programme	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Music in the Parks	*						*								*
Poble Sec Community Climate Shelters			*	*	*	*	*	*	*	*	*	*		*	*
Sustainable Schools Programme		*		*					*		*	*	*		
Time Bank Programme	*	*	*			*	*	*				*			*

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