

Education on Sustainable Development Goals

Subjects: [Education & Educational Research](#) | [Education, Scientific Disciplines](#) | [Geography](#)

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Sustainable development goals express a spatial concern about the main challenges facing the world today: ecological, economic, social, and political. Geography is the science of place (of where). Education for sustainable development is the responsibility of many educational and social agents, although there is a broad consensus that universities play a fundamental role as institutions training qualified professionals; building the capacity of new generations; and mobilizing young people who, once in the workplace, can multiply the effects of their actions and decisions to contribute to the achievement of the SDGs.

[education](#)[sustainable development](#)[gender empowerment](#)[sustainable cities](#)[Collaborative Mapping](#)[Geographic skills](#)[Digital skills](#)

1. Introduction

Geography is usually known as a school subject and field in the sciences that studies the Earth's surface and the spaces and places where relationships between people and the environment happen. Geography explores the interactions between the physical environment and human societies, which produce landscapes, distributions, impacts, and spatial patterns from the local and regional to the national and global scale. Geography is the science of "where" and guides the inquiry process to acquire knowledge about how and why place, space, and environment matter. Geography contributes to raising awareness about the human and cultural diversity on the Earth. Geography studies not only locations but also how these locations develop and change over time. Geography is a scientific discipline that deals with the processes of spatial organization of human societies. Thus, geography is the academic discipline and school subject that equips students well with knowledge, skills, and values related to education on sustainable development goals.

First, geography is the most interdisciplinary discipline in school, allowing students to acquire physical and social environment vocabulary, process meaningful statistics, implement scientific methods, acquire personal and social (territorial) identity and citizenship, develop cultural awareness from natural and human landscapes, etc. Consequently, geography is an appropriate subject to promote sustainable development (goals) education from multiple perspectives (economic, social, and environmental) ^[1] as all the sustainable development goals are rooted in a branch of geography. This is because geography is a spatial science encompassing both social sciences (human geography) and natural sciences (physical geography); it can be linked to all the SDGs, as formulated in **Table 1**.

Table 1. Connections between geography and SDGs.

SDG		Geographical Branches
1	No poverty	Social and economic geography
2	Zero hunger	Social and rural geography
3	Good health and well-being	Social geography
4	Quality education	Social geography
5	Gender equality	Social geography
6	Clean water and sanitation	Hydrogeography
7	Affordable and clean energy	Industrial geography
8	Decent work and economic growth	Economic geography
9	Industry, innovation, and infrastructure	Transport and economic geography
10	Reduced inequalities	Regional geography
11	Sustainable cities and communities	Urban geography
12	Responsible consumption and production	Economic geography
13	Climate action	Climatology
14	Life below water	Biogeography and hydrogeography
15	Life on land	Biogeography
16	Peace, justice, and strong institutions	Political geography
17	Partnerships for the goals	Political geography

Secondly, geography is probably the subject where the technologies (in particular geospatial technologies, GIS, digital atlases, remote sensing, geolocation-based mobile apps, etc.) have had a greater impact on innovative learning and educational benefits: instructional resources, pedagogies, inquiry, problem-based learning, etc. ^[2].
Source: De Miguel, 2019.

Geography is an essential contribution to the achievement of the United Nations Agenda 2030 and Sustainable Development Goals (SDGs), as indicated by several recent studies ^{[3][4][5][6][7][8]}. Due to the transversal approach of the SDGs, geography is the most important school subject for education on sustainable development goals ^{[9][10]}, as can be seen in the examples of good practices in European geographic education ^{[11][12][13][14][15]}.

Sustainable development goals express a spatial concern about the main challenges facing the world today: ecological, economic, social, and political. Geography is the science of place (of where). Physical geography has traditionally been devoted to research into the biosphere and hydrosphere. Human geography studies where people live and how different societies (geographically and politically) develop productive activities, as well as their

impact on the environment. In this way, each of the apparently novel sustainable development goals is intellectually indebted to the different fields of study of geography, scientifically consolidated over decades, as shown in **Table 1**.

2. Geography Education for Sustainable Development: Teacher Education Challenges

Education for sustainable development is the responsibility of many educational and social agents, although there is a broad consensus that universities ^[16] play a fundamental role as institutions training qualified professionals; building the capacity of new generations; and mobilizing young people who, once in the workplace, can multiply the effects of their actions and decisions to contribute to the achievement of the SDGs. In addition to educational function, universities have a critical role in delivering SDGs because of the capabilities in research, governance, and particularly external leadership and public engagement. To address SDG education, raise awareness, and implement, university members are well equipped to the transformative learning carried out in higher education activities: interdisciplinary knowledge, action-based learning, and multi-actor involvement (government, civil society, and private sector).

Educational disciplines, both in compulsory and higher education, require specific professional knowledge and skills, including understanding how the SDGs and global sustainable development challenges are relevant to one profession, sector, or activity. This means specialized knowledge and skills that will help the learners advance the SDGs through this profession. Examples include management, engineering, public policy, research, health, information, and communication technology, in addition to teaching in the primary and secondary education sector. This is also expressly stated and highlighted by SDG target 4.7, “ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development” and by indicator 4.7.1.c, “Extent to which education for sustainable development, are mainstreamed at all levels in teacher education” ^[17].

Consequently, in Spanish universities, teacher training is a key factor in providing education on sustainability and sustainable development goals. However, what are the perceptions, knowledge, and skills of future teachers regarding SDGs before and after training? Research on the progress of students in teacher education programs on SDG knowledge and skills, as well as on pedagogies integrating SDGs into their teaching practice (or internship), shows that progress and improvement in their training with respect to the role of sustainability in education have been observed in three dimensions of analysis: education for sustainability, SDGs, and the methodological strategies for their integration ^[18]. In Spanish universities, four cross-curricular skills for sustainability have been agreed on for implementation in higher education, later tracked in research projects describing a rubric for the assessment of competencies of sustainability for teacher education degrees ^{[18][19]}. This rubric is based in the simplified pyramid of Miller and enables evaluation of new teachers on three dimensions: what they know about sustainability, if they are able to promote sustainability and how, and if they are able to develop educational strategies that promote sustainability in their students.

However, not all teachers have the same content on SDGs in their respective school curricula, and so not all of them have the same opportunities to teach sustainability. Teachers of natural and social sciences, and especially geography teachers, have a great responsibility for educating on the SDGs because of the interdisciplinary nature of knowledge, as mentioned above. Teaching and learning methods for promoting sustainability via geography have not been thoroughly studied, despite the proclamation by the International Geographical Union, in 2007, of the Lucerne Declaration on Geographical Education for Sustainable Development ^[20]. A recent qualitative study ^[21] ^[22] has examined publications on geographical education for sustainable development and has drawn attention to some essentials, such as geographical and interdisciplinary competencies, learning topics, teaching and learning methods, and fieldwork and outdoor learning ^[23].

Two important aspects must also be taken into consideration for the conceptualization, development, implementation, and assessment of geographical education on sustainable development: curriculum and geospatial technologies. Defining a theoretical framework for geographical education on sustainable development ^[24] involves five phases: learning the directions and benefits of education on sustainability, educating the educators, identifying the pedagogies, taking action, and providing practical geographical education on sustainable development. Geospatial technology has proven to be the most effective tool for teaching and learning school geography in recent years, due to the wide availability of spatial data and the implementation of the technological, pedagogical, and content knowledge (TPACK) ^[25]^[26], as published in ^[2]^[27]^[28]^[29]^[30], even for geographical education on concrete sustainable development goals ^[12]^[23]^[31]^[32]^[33]^[34]^[35].

3. Role of GIS in Supporting ESD: The Importance of Implementing SDGs 11 and 5 in Education

The workshop held at the University of Zaragoza is related to the importance of neo-geography in the current social context, meaning the reinvention of the geographic science and the normalization of methods, techniques, and tools for non-expert users ^[36]. GIS offers society the possibility to create new spatial information of their environment. This has been made possible due to the simplicity of the skills involved in current collaborative mapping: mainly the use of Global Positioning System (GPS) devices and simple observation to collect information. Such initiatives have increased recently due to the COVID-19 pandemic, which has accelerated the overall process of digitalization and, thereby, digital collaborative mapping. In the current context, individuals no longer need to go out and do field work to be involved with their community. Volunteers can now participate in the causes they believe in from the comfort of their home, school, or working environment through an Internet-connected device. This particular type of volunteering, known as active citizen-sensor data, has skyrocketed in the past few years as technology has become ubiquitous (mobile devices, affordable sensors, web platforms, etc.), and even more so during the lockdowns and stay-at-home orders to curb the COVID-19 crisis ^[36].

Geographers are not the only ones using digital volunteering and citizen science. Many fields are taking advantage of this. Several disciplines have directly benefited from citizen contributions, particularly researchers of earth sciences and other sciences related to sustainable development, such as biology ^[37]^[38] and astronomy (Planet Hunters project). Disciplines such as archeology, ecology, and urban studies have also profited from this collective

effort. One of the latest causes to join this practice for social change is topophilia (a strong sense of place), where the volunteers try to improve aspects of their close social and daily environment by mapping aspects of their surrounding community to improve the understanding, identity, and public space appropriation. This practice goes beyond a philanthropic act and serves to build strong ties within the community and empower minority groups.

Gender geographers, in their attempt to report and transform situations of daily sexism or latent discrimination, focus on how GIS and cartography underrepresent elements typically associated with women or how they reflect a male-dominant society through maps [39][40]. They have created feminist cartographies and visualizations, leading to the development of alternative cartography to the mainstream GIS representation [40][41].

Consequently, feminist geographers have also joined the collaborative mapping trend and use this innovative map-making method to further their agendas, seeing in crowd mapping a mechanism not only to subvert the male-oriented traditional cartography but also to empower women. An early illustration of the use of this method at the intersection of space, gender, and sexualities meant a move from the researchers bearing the burden of the map-making process to the people whose experiences were being mapped being responsible for the decisions about the data included in the map and how they will be represented [42]. Harassmap, in Egypt, or Women Under Siege, in Syria, are other crowd source mapping projects that have sprung up in recent years to make sexual harassment visible and to allow for these crimes to be reported, making these maps an advocacy, prevention, and response tool [43]. Lastly, a recent exploratory quantitative analysis of gendered contributions to the online mapping project OpenStreetMap (OSM) observed a strong male participation bias and identified differences in men's and women's mapping practices, which translated into aspects of women's specific needs and priorities, such as hospitals, childcare services, toilets, domestic violence shelters, and women's health clinics, being clearly underrepresented [44].

Another group based on OSM, GeoChicas [45], has recently been considerably active in training women on how to use OSM, hosting several "mapathons" to allow women to map their environment and overcome the male bias in crowd-sourced cartography. GeoChicas is a group of Spanish-speaking people linked to OSM that work to empower women and reduce the gender gap in OSM communities associated with open-source software and open-source data. Several projects in Spain and Latin America are currently being conducted by another group, also responsible for the project *Las Calles de las Mujeres* (roads of women). The projects analyze streets named after women in capital cities across the world, including Zaragoza, with the help of another group, *GeoInquietos* (Geo-restless).

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