

Geoethics and Education for Sustainability

Subjects: **Geology**

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The United Nations 2030 Agenda is a plan designed to encourage prosperity that is respectful of the planet and its inhabitants. The Agenda will help introduce the concept of education for sustainability (EfS) to a wider population in order to promote inter- and trans-disciplinary knowledge about sustainability. Connecting Earth Sciences (ES) with sustainability allows us to deal with the ethical dimensions and the social implications of this field. Geoethics is defined as the “research and reflection on the values which underpin appropriate behaviors and practices, wherever human activities interact with the Earth system” by the International Association for Promoting Geoethics (IAPG).

geoethics

education for sustainability

sustainable development goals

1. Introduction

The 2030 Agenda [1] was launched by the United Nations during a summit in September 2015 and it was formally and unanimously adopted by the 193 member states during the 21st Conference of Parties (COP21) held in Paris in December 2015. The main purpose of this Agenda is to eradicate poverty in all its forms and dimensions, in order to shift the world onto a sustainable and resilient path [1]. The Sustainable Development Goals (SDGs) have been chosen to achieve this purpose.

The 17 SDGs are divided into 169 targets and have been designed to better address the aims of this major project, which has the year 2030 as its target date.

Achieving the 17 SDGs has become a great challenge for many sectors of society (e.g., industry, education, communication), and, from the outset, scientific knowledge has been essential to guide, measure and achieve these goals [2].

Many, if not all, of the SDGs, are related to the Earth Sciences (ES) and therefore it is necessary for the geological scientific community to recognize the role it can play and to be ready to act for this common purpose, sometimes assuming the lead role in delivering the SDGs [3]. The geological scientific community also has a key role in delivering Environmental Education (EE), which fits perfectly in the achievement of the 17 SDGs.

Is the geoscience community aware that proper education in ES can be a vector for change?

To better understand if this awareness currently exists among young Italian geoscientists, researchers present the results of a survey conducted between the participants of BeGeo 2021 [4], the first national congress in Italy for

young geoscientists (i.e., BSc and MSc students, PhD candidates and PhD graduates who had graduated less than 3 years before).

The age of participants is meaningful for the research, in fact, most of them were under 30 years of age and at the end of their academic studies or at the beginning of their working life. This provided an insight into the current state of awareness regarding geology as a tool for achieving the SDGs within the different national university curricula.

The decision to have a national focus was supported not only by the unique opportunity to have a conference that brought together a perfect sample of people useful for the research, but also by the fact that in Italy, since the 1970s, a discussion on the ethics of geosciences has begun. In recent years, this has led to the birth of a discipline called Geoethics, whose major exponents include Italian geoscientists [\[5\]](#)[\[6\]](#)[\[7\]](#)[\[8\]](#).

2. From Environmental Education (EE) to Education for Sustainability (EfS)

The beginnings of EE are grounded in the early 1960s, after the publication of the book by Rachel Carson [\[9\]](#), which unveiled the potential large-scale impact of human beings on the planet. The roots of the EE could also be extended further back in time to the 19th century, as far as Wilbur Jackman [\[10\]](#) and Anna Botsford Comstock [\[11\]](#) who published two books that are commonly considered two of the first examples of a pedagogical approach that encourages taking students outdoors for learning experiences [\[12\]](#).

The idea itself of Outdoor Education (OE), strictly connected to EE, was born in Germany in the same period and then spread mostly in Northern Europe within the half of the century [\[13\]](#). Moreover, many other movements prior to 1960 have supported the development of the EE [\[14\]](#).

The first formal definition of EE was developed in a seminar at the University of Michigan. Environmental Education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution [\[15\]](#). In the same document the main objectives of EE are underlined, the first of which is a clear understanding that humankind is an inseparable part of a system that could be altered and damaged if we are not aware of it. At the end of the document, there is a call to inform citizens of the world about how they can implement EE.

This call for change was met by the UN's Stockholm Declaration, in particular its 19th Principle about education [\[16\]](#), and then by the Tbilisi Report, a result of UNESCO's First Intergovernmental Conference of Environmental Education, which emphasizes the role of EE as a solution to the major problems of the contemporary world [\[17\]](#).

Later, the Brundtland report [\[18\]](#) helped to find the link between the EE and sustainable development, defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs [\[18\]](#). This report and the following Agenda 21 [\[19\]](#) have been the basis for the concept of Education for Sustainable Development (ESD) as a valuable approach to EE [\[12\]](#). With its multiple definitions and wide variety of

interdisciplinary approaches to support sustainability, ESD has been recognized as a key strategy for the achievement of the Millennium Development Goals (MDGs) [20] and then for the SDGs.

Moreover, the UN declared the years 2005–2014 to be the Decade of Education for Sustainable Development (DESD), to highlight the importance of education in achieving the goals of a sustainable future.

The expression “Education for Sustainability” (EfS) has appeared in academic publications since the mid-1990s [21] and has remained in use over the years [22][23] often juxtaposed with ESD, without evident differences. Here researchers refer to the Australian Curriculum, Assessment and Reporting Authority’s definition (ACARA) developed within a National Curriculum for teacher accreditation and teacher education [24]. The Curriculum claims that sustainability is an essential element for young people and defines the EfS as follows: “Education for sustainability develops the knowledge, skills, values and world-views necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence” [24].

It is actually difficult to outline borders and to clearly identify differences between the EE, the ESD and the EfS; even in presence of different definitions above mentioned, the efforts of suggesting specific terms and rhetoric for each one of the three concepts sounds fruitless; on the contrary, it seems pretty clear that collaborative action is more useful than an either-or debate over whose terminology should be adopted [25].

3. Geosciences, Education for Sustainability and SDGs

The role of geosciences in the field of EfS or ESD in promoting and achieving SDGs is ambiguous. From the dawn of the millennium, there has been wide recognition of the increasingly important role of the ES in the path towards a sustainable society [26], in particular in the development of a holistic system needed to understand major earth systems, such as the water and the carbon cycles [27]. Moreover, considering climate change as the major issue that our society faces nowadays, geologists could help to show the potentially dangerous effects that a rapid climate change can have on the Earth [28].

Despite this, it seems that the current discourse on sustainability has left the geosciences behind [29]. Firstly, the call for greater inclusions of the ES to help and guide the 2030 Agenda [2] has largely not been taken into consideration by the geoscience community; on the other hand, in the explosion of SDGs research after 2015, the scene has been largely dominated by the social sciences, and geosciences cover only a small fraction of the research [30] (Figure 1).

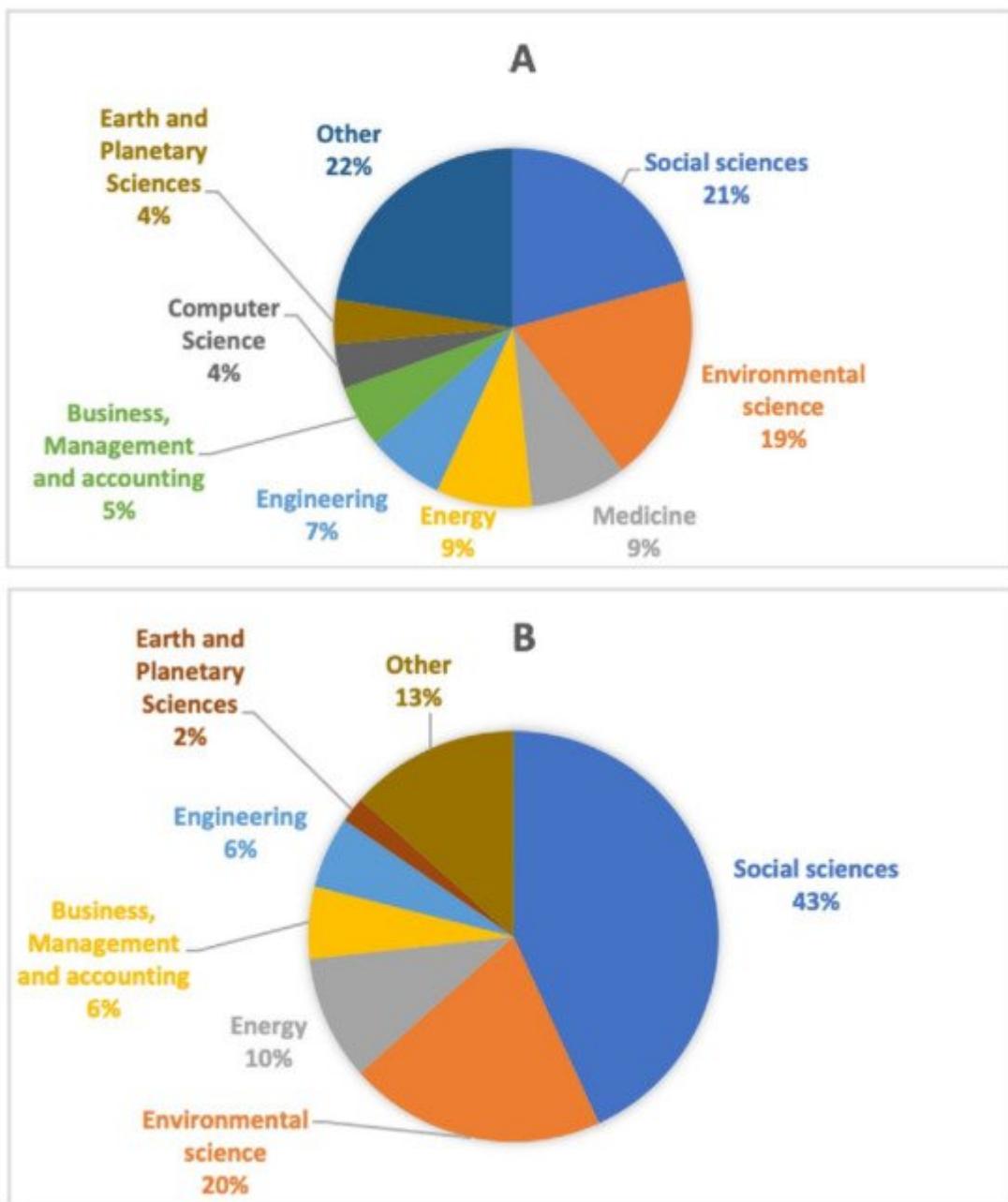


Figure 1. Results of a Scopus search on 10 December 2021. Using in “Title, abstract and keywords” the SDG-related terms “SDGs” OR “2030 Agenda” OR “Sustainable Development Goals” OR “Global Goals”. The subject area “Earth and Planetary Sciences” covers only 4% (A). Using instead “Education for Sustainability” OR “Education for Sustainable Development” the percentage of the area decreases to 2% (B).

Considering the possibility that some papers about geosciences may have been counted under the label Environmental Sciences, the data in **Figure 1** still highlights the minor role of geosciences in sustainability research and sustainability education today. Nonetheless, relating the key aspects of geology with the 17 SDGs, it is easy to demonstrate that geoscientists have a crucial role in achieving them. For this reason, many initiatives were created in order to engage Earth Sciences in the SDGs debate and to improve geoscientists’ awareness of their important role. One of these initiatives is Geology for Global Development (GfGD) [31], a registered charity founded in 2011 by Joel Gill, Senior International Development Scientist at the British Geological Survey and Fellow of the

Geological Society of London. The not-for-profit organization is affiliated with the International Union of Geological Sciences (IUGS) [\[32\]](#) and they both have a shared aim that is to advance international geoscience cooperation to serve society. They support a vision of the world where every geologist is equipped with the skills and the knowledge required to make a positive contribution to sustainable development; the geology community is actively engaged in the design, implementation, monitoring, and evaluation of international development activities.

UNESCO is the only United Nations organization with a mandate to support research and capacity-building in geology and geophysics, and the International Geoscience Programme (IGCP) [\[33\]](#) is its flagship international engagement platform. Moreover, GfGD is a project partner on the IUGS/UNESCO International Geoscience Programme Project 685—Geoscience for Sustainable Development (GeoSD) [\[34\]](#), approved in February 2019 by UNESCO's Earth Science Secretariat. This 5-year research project has the mission to champion the role of geoscience in helping UNESCO address the pressing challenges of the UN SDGs [\[35\]](#).

Additionally, the Geological Society of London (GSL) [\[36\]](#) assumed a role in the promotion of EfS related to geoscience. In particular, a poster was created in 2021 with the aim of making the connection between geology and the SDGs very easy to understand, not only for those classically related to STEM. In fact, it highlights that the geosciences, along with other STEM disciplines, are, or could be involved in all 17 SDGs and effectively help deliver the 2030 Agenda.

Furthermore, with regard to the role of the geosciences in the achievement of the 17 SDGs, a table proposed in 2017 [\[3\]](#) demonstrates all the geological branches helpful in achieving the goals.

4. Geoethics and Sustainability

As mentioned above, the debate around ethics and environmentalism issues in the Italian geoscientific community has led to the emergence of a new discipline, geoethics.

Geoethics is defined as the “research and reflection on the values which underpin appropriate behaviors and practices, wherever human activities interact with the Earth system” by the International Association for Promoting Geoethics (IAPG) [\[37\]](#). Dealing with the social role and responsibility of geoscientists [\[5\]](#), geoethics can be considered a philosophical approach, a school of thought [\[38\]](#) that promotes appropriate practices to shape responsible and sustainable relationships between human activities and the Earth's systems [\[6\]](#).

Following the Italian tradition of reflection on the ethical aspects connected with geosciences [\[39\]](#)[\[40\]](#)[\[41\]](#) the first session on geoethics in a geological conference was organized for the first time in Italy, during the Geotitalia congress in Rimini (2009); at the international scale, the first session on Geoethics was held during the European Geosciences Union (EGU) in Vienna in 2012. In the same year, the foundation of IAPG fostered the creation of a community to share ideas and address geoethical issues [\[7\]](#).

During the 35th International Geological Congress (IGC), held in 2016 in South Africa, a document that summarizes the values, concepts, and contents of geoethics was promoted, providing a perspective for the future development of geoethical thinking [8]. The result was the Cape Town Statement on Geoethics (CTSG) [8], which has been supported, since the beginning, by many geoscience organizations. The CTSG is strictly connected to the previous Geoethical Promise [42], a sort of Hippocratic Oath for geoscientists towards sustainability.

The Geoethical Promise and CTSG are important not only for the geoscience community but also for society as a whole [43]. Indeed, in recent years, geoethical thinking has spread to other techno-scientific disciplines [38].

The ambitious aim of IAPG is a pedagogical proposal based upon geoethics [6], with both formative and political purposes. In fact, both of these aspects should deal with the principles of geoethics, in order to face the big anthropogenic changes and ensure a more sustainable future.

Connecting geosciences with sustainability issues means dealing with the ethical dimension and societal implications of researchers' research studies, as well as researchers' professional activities [44]. From this point of view, the increasing importance given to geoethics in the current debate reflects a demand for this new requirement in geoscientists' curricula [45].

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