


Integrated Science 4


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Enhancing Environmental Education Through Nature-Based Solutions

 Springer

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Chapter 17

Environmental Education in Naturtejo UNESCO Global Geopark (Portugal): A Nature-Based Approach



Maria Manuela Catana and José Brilha

Abstract UNESCO Global Geoparks (UGGps) are excellent teaching opportunities as outdoor classrooms and incubators of sustainable development, sustainable lifestyles, appreciation of natural and cultural diversity, and promotion of peace. Naturtejo UGGp offers educational programmes addressed to the school public (formal education) since 2007, focused on geosciences education for sustainability. These programmes intend to contribute to the conservation and promotion of the local natural and cultural heritage, as well as to the sustainable development of this Portuguese territory. The educational activities are promoted with different partners and are addressed to students and teachers from the kindergarten to the university. Most of the activities are outdoor activities with the purpose to re-connect young people with nature. This link has been weakening particularly in larger towns but it is essential to re-establish an emotional bond between future responsible citizens and the natural environment.

Keywords Education for sustainability · Educational programmes · Formal education · Geosciences education · Outdoor learning · Educational resources · Geological heritage · Natural heritage · Cultural heritage

Introduction

The Man and Biosphere Programme, the Convention Concerning the Protection of the World Cultural and Natural Heritage and Global Geoparks are the three UNESCO's nature-related mechanisms to promote the implementation of Agenda

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2030 for Sustainable Development, adopted by the United Nations in September 2015. The Agenda 2030 comprises 17 Sustainable Development Goals (SDGs) and 169 targets, which are deeply embedded on the economic, social and environmental dimensions of sustainable development [1].

UNESCO Global Geoparks (UGGps) are territories where sites and landscapes of international geological relevance are managed on the base of a holistic concept of conservation, education, and sustainable development [2]. There are 169 UGGps in 44 countries distributed by all continents (numbers as of July 2021). UGGps are perfect laboratories to implement and contribute to achieve the SDGs, as shown in the UNESCO's brochure "UNESCO Global Geoparks contributing to the Sustainable Development Goals—Celebrating Earth Heritage, Sustaining local Communities" [2]. The results of a survey showed that the SDG 4—Quality education—is the most important SDG to sustain UGGps relevant projects [3].

Naturtejo UNESCO Global Geopark has integrated the European and Global Geoparks Network under the auspices of UNESCO in 2006 and is located in central Portugal near the eastern Portuguese–Spanish border [4]. The Naturtejo's territory comprises 5.060 km² and includes seven municipalities: Castelo Branco, Idanha-a-Nova, Nisa, Oleiros, Penamacor, Proença-a-Nova and Vila Velha de Ródão, with 96.500 inhabitants (Census 2011) [5]. As in any other UGGp, Naturtejo has a significant number of geological sites with special scientific, aesthetic, and educational relevance representing the last 600 million years of the Earth's history and evolution of life [4]. In this territory the archaeological, ecological, historical and cultural heritage is also of very high relevance [2]. The management structure of this geopark—"Naturtejo—Empresa de Turismo"—is an intermunicipal major state-owned company established in 2004.

The Role of UNESCO Global Geoparks in Promoting Geosciences Education for Sustainability

All UGGps must develop and promote educational activities for people of all ages, in order to raise awareness of geological heritage and its relationships with other aspects of natural and cultural heritage. Thus, the policies and educational actions concerning geoconservation are very important, either in the school context (formal education) or addressed to the general public (non-formal education). In this work the focus will be the educational activities promoted by the Naturtejo UGGp for the school public (formal education). UNESCO Global Geoparks are excellent tools to assist schools as outdoor classrooms and to be incubators of sustainable development, healthy lifestyles, appreciation of the natural and cultural diversity, and promotion of peace [6, 7].

The analysis of the data obtained with an online questionnaire answered by seventy-three UGGps from thirty-five countries around the world allowed the characterization of the role played by geoparks in the promotion of geosciences education for sustainability through educational programs specifically addressed to the school community [6]. Education is actually one of the pillars of UGGps, and for this reason, most geoparks have a specific educational department in which spends about one-third of the annual budget of the geopark. The responsible person of the educational department has a scientific background on geology and has a permanent contract with the management structure of the geopark. Of the seventeen SDGs (AGENDA 2030), the most explored in educational activities are (in descending order) “four—quality education,” “fifteen—terrestrial ecosystems and biodiversity,” “eleven—sustainable cities and communities,” “thirteen—combating climate change,” “three—healthy life.” The theme “climate change” is a topic addressed by many geoparks, following the Declaration of Shimabara approved during the 5th International Geoparks Conference held in Japan in 2012 [6].

The Educational Strategy of Naturtejo UGGp—“Geonaturescola”

The educational programmes of Naturtejo UGGp are based in the geosciences education for sustainability paradigm and intend to contribute to the conservation, promotion and enhancement of the natural and cultural heritage of the geopark, as well as to the sustainable development of its whole territory [4, 8]. These programmes started in the school year of 2007/2008 and have been getting updated since then. The first edition of these programmes was awarded with the “Ecotourism Award 2008” by Skai International, in the category “Educational Programmes—Media”. Skai International is one of the largest international associations of travel and tourism professionals, created in 1934 [8].

The topics addressed in the educational programmes are adapted to the national curriculum. In Portugal, geology is taught in several years of the basic and secondary school system, which gives the opportunity to teachers to apply the Naturtejo’s programmes in different moments. For instance, when the topic is about the diversity of rocks, there is one specific activity in the geopark focused on this.

The educational value of the geological heritage of Naturtejo UGGp is corroborated by its inclusion as an educational resource in the national curriculum. Questions about its geoh heritage have already appeared in national exams addressed to secondary school students [8] and some textbooks of natural sciences (7th grade) present texts and photographs of the geopark’s geodiversity, besides being suggested as a relevant destination for field classes.

The Geopark's Educative Service

The Naturtejo UGGp has recognised the importance of the education pillar since its very first beginning as a geopark. An educative service was setup in the school year 2007/2008 with a coordinator properly trained for the job (Bachelors on Biology and Geology Teaching and a Master Degree on Geological Heritage and Geoconservation). This coordinator has the responsibility to design, implement and assess the educational activities of the geopark and also to train other monitors involved in assisting educational activities. These monitors receive a theoretical training on national curriculum topics and field training before they start to work with students and teachers.

The objectives of the geopark's educative service are [8]:

- to be a complement to the national curricula;
- to help teachers to diversify the type of strategies they use to teach geosciences topics and others;
- to encourage a healthy direct contact with nature;
- to raise awareness of the importance of the protection and conservation of natural and cultural heritage;
- to promote actions to value, conserve and improve the environmental conditions;
- to promote the use of scientific instruments associated with field work;
- to foster a direct contact with the objects of study (for instance, fossils);
- to generate significant learning;
- to increase scientific literacy;
- to contribute to active citizenship.

The primary target groups are students and teachers of preschool, primary, secondary, and higher education, vocational education and senior universities within Naturtejo's territory and from other Portuguese institutions. Some programmes are also adapted to foreign students. The programmes cover not only topics included in geology and biology disciplines, both also other disciplines such as Geography; Environmental Education; History; Physical Education; Tourism (of Nature); Rural Development; Marketing, Land-use Management; Protected Areas; Portuguese; Physics; Chemistry. Optional nature sports activities included in some programmes are organised by private companies partners of the Naturtejo UGGp [8].

Nowadays, the educative service—"Geonaturescola" ("Geonatureschool") [9]—has 30 partners including two universities and one researcher centre, a teachers training centre, a NGO, seven private companies, 12 museums/science and environmental interpretation centres, two protected areas, the Tejo/Tajo International Transboundary Biosphere Reserve, the National Forum of UNESCO Global Geoparks, and the National UNESCO Commission.

Educational Resources of Naturtejo UGGp

The educational programmes of the geopark are obviously based on the natural and cultural resources of the territory, selected for their high educational value. In addition, these programmes also include interpretative centres and museums, walking trails and a boat/kayaks trip (Table 17.1) [8, 9].

Thirteen geosites out of the 176 geosites inventoried in the whole geopark were selected to be included in educative programmes [10], together with nine interpretative centres/museums out of the 40, and eight walking trails out of the 22. The boat/kayak trip is offered at the “Portas de Ródão” Natural Monument, where the Tagus river crosses a quartzite ridge in a dramatic landscape.

In addition to these resources, the educative service has also other resources that are used to help the teaching/learning process, such as:

- Illustrations and photos used in guided field trips;
- Models of trilobites, *Cruziana* and other fossils;
- Fossil replicas;
- Booklets and field trip guides for students and teachers [11];
- Scientific papers related with specific aspects of each field trip;
- Children’s books and PowerPoint presentations;
- Games and puzzles of the geological map and geosites;
- Songs;
- Rock, fossil, and mineral collections;
- “Litoteca do Geopark Naturtejo”—box with 27 rock samples of the geopark.

Virtual educational resources produced by the geopark staff in partnership with trainee students of the Polytechnic Institute of Castelo Branco are also available, both on the geopark’s website (www.naturtejo.com) and on the microsite dedicated exclusively to educational programmes “Geonatur school” (www.geonaturescola.com), such as:

- “Litoteca virtual do Geopark Naturtejo”—virtual box with rock samples;
- Virtual visits to Segura and Monforte da Beira mines;
- Interactive simple games (crosswords, puzzles, quizzes).

Due to Covid-19 pandemic and to the fact that schools had to quickly convert the teaching methods, in 2020 a new tab was created on the geopark’s website (“NaturtejoGeoparkAtHome”) (<https://naturtejo.com.casa.php>) where links to online resources were gathered, either produced by the geopark or by other organisations.

Regarding the production of educative resources, it is worth to mention the results of the participation of Naturtejo UGGp in two European projects.

“Field Geosciences Teaching Module: Geoparks and Geosites—Naturtejo Geopark” [12] presents six geosites of the geopark and include documents for teachers (field teaching activities planning, presentations) and for students (worksheets). This resource is available in Portuguese and English and was one of the outcomes of a Lifelong Learning Programme—COMENIUS project, held between 2010 and 2013.

Table 17.1 Main resources of the Naturtejo UGGp used in educational programmes

	Educational resources of the geopark	Main theme
Geosites	Penha Garcia Ichnological Park	Palaeontology
	Portas de Almourão Geomonument	Fluvial geomorphology and tectonics
	Zêzere Gorge	Fluvial geomorphology
	Segura Mines	Mining
	Inselberg of Monsanto	Granite geomorfology
	Ponsul's Fault Scarp	Tectonics
	Fossil Logs of Vila Velha de Ródão	Palaeontology
	Erges River Canyons	Fluvial geomorphology
	Fraga da Água D'Alta Waterfall	Fluvial geomorphology
	Portas de Ródão Natural Monument	Fluvial geomorphology
	Granite Landforms of Gardunha	Granite geomorphology
	Conhal do Arneiro Gold Mine	Ancient mining
	Roman Mining Complex of Presa	Ancient mining
Interpretative centres and museums	Environmental Interpretative Centre of Castelo Branco	Biodiversity
	Interpretative Centre of Rock Art of the Tagus Valley	Archaeology, geology and palaeontology
	House of Arts and Culture of Tagus	Palaeontology
	Stonemason's Museum	Granite quarrying and uses
	Lands of Idanha Biodiversity Interpretative Centre	Biodiversity, rocks and ancient mines
	Raiano Cultural Centre	Agriculture
	Fossils House of Penha Garcia	Palaeontology
	Municipal Museum of Penamacor	Archaeology
	Living Science Centre of the Forest	Forest
Walking trails	Gardunha Trail	Granite geomorphology
	Mines Trail	Mining
	Fossils Trail	Palaeontology
	Boulders Trail	Granite geomorphology
	"Conhal" Gold Mine	Mining
	Orvalho GeoTrail	Fluvial geomorphology and tectonics
	Secrets of "Almourão" Valley	Fluvial geomorphology and tectonics
	Travel by the Earth Bones	Fluvial geomorphology and tectonics



Fig. 17.1 Teachers participating in a TeachOUT App Workshop at Inselberg of Monsanto geosite

“TeachOUT App” allows teachers to create their own exercises in partnership with teachers of other disciplines, to add a number of multi-sensory contents (e.g. treasure hunts, questionnaires, observation, listening, recording short films, works with maps), and to enrich their usual classroom work with a classroom in nature (Fig. 17.1) [13]. This app was produced under the scope of the ESTEAM Project (www.esteem.project.eu), co-funded by the ERASMUS+ Programme [14].

Types of Educative Programmes

In the school year 2020/2021 three educational programmes were offered: “School meets the Geopark”, “Geopark goes to School” and “*Anim’a Rocha*” [15, 16].

The “School meets the Geopark” programme is intended for students from Portuguese schools and also from foreign schools, with some adaptations [15]. In order to promote this programme in schools located inside the geopark, students coming from these schools benefit from discounts on these activities. This educational programme is based on twelve interdisciplinary field trips of half a day or one day duration and two interdisciplinary field trips of two or more days duration (Fig. 17.2).

The “Geopark goes to School” programme is mainly addressed to schools of the Naturtejo’s territory [16]. It consists of two field trips and eight workshops that take place in the classroom” [17]. Both the field trips and the workshops are offered free of charge for schools located in the geopark, with the exception of the workshop about fossils.

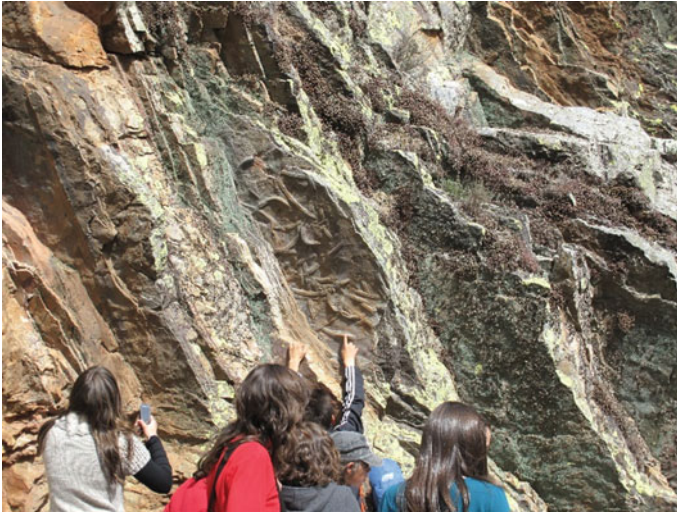


Fig. 17.2 Students participating in a field trip of the educational programme “School meets the Geopark” at Penha Garcia Ichnological Park geosite

The “Anim’a Rocha” programme is only addressed to schools located inside the geopark [18, 19]. This programme comprises several possible activities such as:

- Annual multi-stage projects (e.g. activities pre-field trip in the classroom; field trips; workshops; project work; exhibitions/presentations of the project outcomes) (Fig. 17.3) [19];
- Temporary exhibitions and associated educational activities;
- Celebration of thematic days/years (e.g. International Earth Day/National Geological Heritage Day, World Environment Day, Day of the Native Forest (Fig. 17.4));
- Specific contests addressed to Portuguese geoparks and co-organized by the National UNESCO Commission and the Portuguese Committee for the UNESCO International Geosciences Program (IGCP) [20] about environment and sustainability topics (Climate change and biodiversity; Natural resources for sustainability; The water that unite us; How to improve the environmental quality of my community; Desertification; It is the soil that sustains life). These contests include exhibitions and presentations of works done by students and student exchange between geoparks, usually implemented during the European Geoparks Week/Landscape Festival.

In addition to these activities addressed to students, some educative programmes are also focused on teachers, namely training courses (e.g., Naturtejo UGGp as an educational resource; Geodiversity and biodiversity of Naturtejo UGGp), seminars, workshops and field trips. Teachers from kindergarten to high school come from schools located inside and outside the geopark and are challenged to create their own educational resources to use with their students.



Fig. 17.3 Activity of gathering litter along the Ponsul river during a field trip of the “Project rivers” related to “Anim’a Rocha” educational programme



Fig. 17.4 Celebration of the Native Forest Day with tree planting included in “Anim’a Rocha” educational programme

Promotion and Evaluation of Educational Programmes

An effective promotion of educational programmes is crucial for its success. The Naturtejo geopark tries to guarantee a widespread information about its educational offer, namely through:

- Direct contact with teachers;
- Emails sent to schools;
- Edition of printed and online booklets;
- Social media;
- A specific microsite (www.geonaturescola.com) dedicated to educational programmes under the main geopark’s website (www.naturtejo.com) [9].

It should be noted that there is a contact and a registration forms in the microsite for the field trips included in the “School meets the geopark” programme.

The evaluation of the educational activities is based on the feedback given by the monitors of the geopark staff that were leading the activities and also on the data received through paper-based satisfaction surveys filled by teachers [9]. In the early years of the organisation of educational activities, students also filled satisfaction surveys but the very high number of questionnaires discouraged this procedure.

The number of Portuguese students and teachers that have participated in educational activities of the geopark is shown in Figs. 17.5 and 17.6. It should be noted that some students and teachers participated in more than one activity per school year and on different occasions.

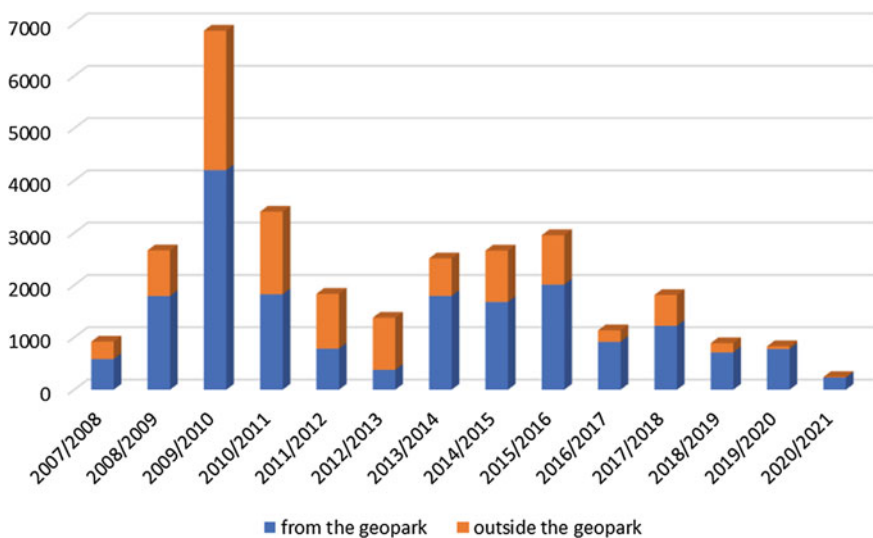


Fig. 17.5 Number of Portuguese students in educational activities, coming from schools located inside (blue) and outside (orange) the geopark

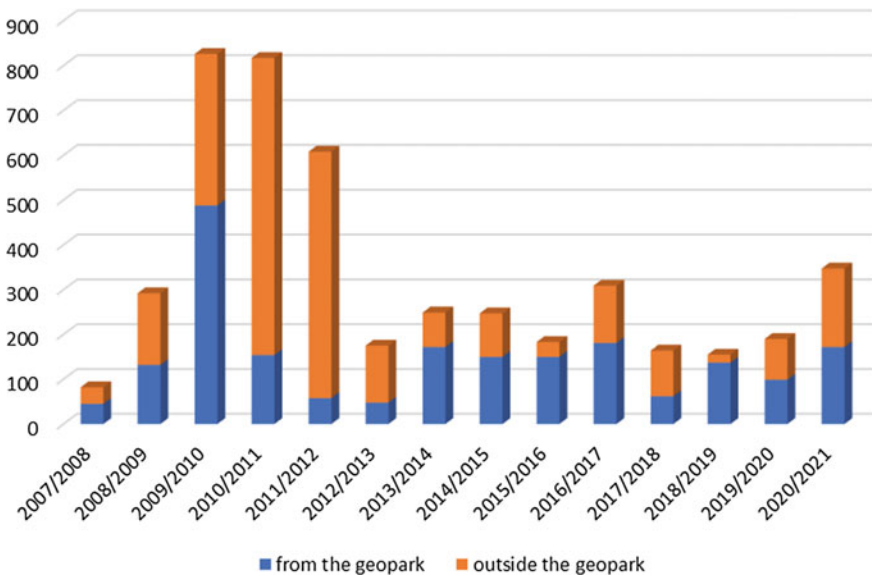


Fig. 17.6 Number of Portuguese teachers in educational activities, coming from schools located inside (blue) and outside (orange) the geopark

Both figures show that the number of students and teachers involved in Naturtejo's educational programmes is not uniform along the years. There are several factors that explain the variation of these numbers, namely:

- Existence of special events that temporarily attract a higher number of students/teachers. This happened in 2010/11 when the geopark offered "Dino-Expo", a temporary exhibition that attracted a high number of schools from all over the country;
- The economical context of the country. During 2011/2012 and 2012/2013 the country faced a severe austerity which obliged schools and families to suspend expenses considered non-fundamental;
- The increase of bureaucracy in schools tend to discourage teachers to organise activities outside schools;
- The availability in the geopark of monitors that lead educational activities;
- The offer of lifelong teachers training which is responsible for the increase of the number of involved teachers in certain years.

In addition, it is obvious that covid-19 pandemic has caused a major disruption on Naturtejo's educational activities (2020/21 school year). However, while the in-person activities for students have been suspended since March 2020, it was possible to offer some online activities addressed to teachers, which explains the increased number in 2020/2021.

The number of foreign students and teachers involved in the educational programmes follows the same general trend, in comparison with national students

and teachers but obviously with less expression. Most foreign students and teachers came from Spain and USA.

Final Considerations

The establishment of geoparks has created an excellent opportunity to develop nature-based environmental education. Due to the fact that education is one of the geoparks' pillars, the number and quality of educational programmes focused on nature and environmental topics offered by geoparks has increased significantly in many countries.

In Portugal, Naturtejo UGGp has started a "revolution" in Portuguese schools 14 years ago. The educational programmes offered by the geopark were very well received by teachers that were eager to have new tools to improve their teaching. For this very good acceptance contributes the close relation between national curriculum topics and the proposed educational programmes.

In spite the success of Naturtejo UGGp concerning formal education, there are still several challenges that are probably similar to many other UGGp:

- To improve the evaluation procedure regarding activities addressed to students (e.g. setup of online forms to simplify the data analysis);
- To increase the number and diversity of themes;
- To publicize the educative programmes more effectively;
- To increase the number of students involved in activities;
- To promote greater opportunities for immersion and contact with nature to help students to reconnect with it;
- To continue to offer teacher training focused from kindergarten to high school;
- To promote more annual educational projects with schools inside the geopark;
- To create itinerant exhibitions for schools;
- To create the "Schools of Naturtejo Geopark Network";
- To increase the number of monitors and the training of guides from private companies that would like to offer educational activities;
- To improve and translate the educational microsite to English;
- To establish partnerships in order to develop an education centre where the educational resources can be stored and lab/field activities/workshops can be organized with students and teachers.

This work was focused on the Naturtejo UGGp strategy towards formal education but it should be emphasized that this geopark is also deeply engaged on the promotion of activities and resources about environmental education for sustainability addressed to general public. It is expected that all this combined educational effort will contribute to a necessary change of minds of the society and to create more responsible citizens with basic knowledge to allow them face the environmental challenges coming ahead.

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