



Article

The Need for Geoethical Awareness: The Importance of Geoenvironmental Education in Geoheritage Understanding in the Case of Meteora Geomorphes, Greece

Efthymios Georgousis ^{1,*} , Socrates Savelides ², Spyros Mosios ², Maximos-Vasileios Holokolos ³ and Hara Drinia ^{1,*} 

¹ Department of Geology and Geoenvironment, National and Kapodistrian University of Athens, 15784 Athens, Greece

² Hellenic Ministry of Education and Religious Affairs, Directorate of Secondary Education of Magnesia, 38333 Volos, Greece; socrates@sch.gr (S.S.); smosios@uth.gr (S.M.)

³ Department of Culture, Creative Media and Industries, University of Thessaly, 38221 Volos, Greece; mcholokolos@uth.gr

* Correspondence: egeorgousis@geol.uoa.gr (E.G.); cntrinia@geol.uoa.gr (H.D.)

Abstract: The purpose of this article is to explore the young generation's geocultural consciousness. The research uses the case of Meteora Geomorphes, which have been proposed as a geological heritage site and are known to students for aesthetic, cultural and religious reasons. The sample of the research consisted of third grade Junior High school (Gymnasium) pupils, who have been taught Geography–Geology courses in previous classes, and students from departments of the University of Thessaly, Central Greece, wherein their subjects are taught cultural heritage courses. The data collection was conducted through a structured questionnaire that examines their knowledge, values, geoethical attitudes, behaviors and beliefs about geocultural heritage understanding. The result of the research shows the lack of understanding of the geological heritage in relation to cultural heritage and of the sense of responsibility for the environment and a code of ethics for protection and conservation. The need for strategic educational planning of geoeducation in school practice with the integration of geoheritage in the theme of environmental education (geoenvironmental education) is obvious.

Keywords: geocultural heritage; geoethics; moral values; geoenvironmental education; Greece; Meteora conglomerates; quantitative analysis



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1. Introduction

Greece is a living, geological laboratory with high geodiversity, which has a special environmental, scientific, educational and cultural value, which must and can be used for information and education and consequently public awareness [1–3]. Geological education that aims at the development of geological thought through the proper utilization of geological knowledge contributes to awareness. This knowledge in the Greek educational system is provided in Primary Education through a series of courses-thematic units of a few teaching hours, in the context of the course of Geography, taught by unskilled geology teaching staff [4].

In Lower High School Education, students' education in geosciences is provided through the subject of Geology–Geography. This curriculum lacks topics of geological and palaeontological heritage, as well as geomorphic and fossil sites and relevant remains to illustrate natural processes and the History of Earth [5]. Therefore, the education of students is characterized as very limited or non-existent and is considered incomplete to negligible in the field of geosciences and geoenvironmental sciences [6], although the knowledge of geosciences is important for everyday life [7]. Thus, when students complete school education, they know little about the natural geological environment in which they live [6].

Students must understand the natural environment and the interaction between people and the environment. Furthermore, to develop a code of ethics for protection and conservation and a sense of responsibility for their environment, students should acknowledge places of geological heritage as protected areas and as well the need to manage them [8]. Thus, it is important to support the prospect of developing geological knowledge, not only through the teaching of Geography but mainly through Environmental Education [4,9]. However, despite the richness of the geological-geomorphological heritage of Greece and its direct connection with Environmental Education, the environmental groups of Greek schools that choose to develop an environmental program with a geoenvironmental theme are very limited [10], according to the data published annually. In contrast to the prevailing situation in schools, there are positive examples of planning and implementation of educational activities in geologically protected areas organized for elementary and high school students [11].

The above findings are based on the shortcomings that have been identified in the curricula of the subject of Geology–Geography and the absence of relevant topics in the Educational Programs of Environmental Education. In contrast to the geological heritage, the orientation of the curricula in the understanding of the cultural heritage is evident through various disciplines (History, Religion, Literature, Visual Arts) and several Cultural Programs that are prepared annually voluntarily in Greek schools. However, no research has been conducted on the geological understanding and geoethical awareness of pupils and students, nor on cultural heritage understanding. Therefore, the purpose of this research is to investigate the young generation’s geocultural consciousness. In this research, we draw attention to the geological dimension of the world-famous cultural heritage object, namely Meteora Geomorphes, in Greece, to establish the young generation’s understanding of the geological heritage concerning cultural heritage.

The choice of the Meteora rocks site is due to the global uniqueness of this geoenvironment, which is a geomorphological structure with all the natural variables in interaction with the Earth and Humankind that influence the historical and cultural tradition and aesthetic values. In the case of Meteora, the human factor connects elements of geodiversity with the Orthodox Christian tradition. This combination of geological, natural, historical and religious elements as in similar cases in specific integrated geohistorical monuments [12], emphasizes the importance of geopieté as a source of geocultural heritage and as an influence on the fate of natural geoheritage because of the pressures exerted by the pilgrims can cause significant degradation of the space [13].

The Values of Geoheritage and the Role of Geoeducation

Meteora is a geosite, with particularly powerful ties between geology and culture, and multidisciplinary value associated with specific values. In this part, we provide a short overview of the relevant concepts and values of cultural and geological heritage in order to understand the need to investigate pupils’ and students’ values, on geoheritage-related issues.

Geoheritage is an important part of the natural heritage that needs to be maintained for the benefit of future generations. Many geological or geomorphological features possess intrinsic geological value and are of particular interest to science and education [14,15]. Their economic value is revealed in the concept of “geotourism” [16], which focuses specifically on geology and the landscape [14].

Geoheritage includes those elements of natural geodiversity that have significant value for humans for non-exhaustive purposes and do not reduce their intrinsic or ecological values [17]. These elements are considered to have values such as scientific, educational, aesthetic, ecological and cultural [14,15,18] with historical, archaeological, spiritual and religious aspects, connecting geodiversity with the Earth, its people and their cultures [19,20]. However, the role of geodiversity, despite its importance, remains slightly neglected in relation to biodiversity [21]. The most difficult value in terms of its understanding is the intrinsic value, although as an idea is a well-recognized concept in environmental

ethics [22]. Intrinsic value is the value within an object itself [23] which is not depending only on ecocentric approaches.

The study of geocultural heritage provides moral values for society [24]. Geoethics, as an interdisciplinary endeavor, promotes these ethical values [25] in order to sensitize society about the problems associated with geoenvironment [26], make people realize their role as an active geological force [27] and re-examine their relationship with the Earth system [28]. In Geoethics as a reference scale for valuing moral adequacy [29] may be exploited the evolutionary perspective of Kohlberg's moral development [30], which includes six stages on three levels (preconventional, conventional, post-conventional).

Geoethics promotes geoeducation to raise awareness, growth of values and liability, especially among young people [31]. According to Andrășanu [32], geoeeducation should be considered in a wider context as part of sustainable development education, so it has to develop its own structure and educational tools. Geoeeducation under the prism of the sustainable development model can contribute to social equality, economic growth and environmental protection.

2. Geological and Historical Background of Meteora Geomorphes

The Meteora Geomorphes have been deposited in the Mesohellenic Trench, the youngest and largest of the three molassic sediment trenches of Greece, during the Early Miocene (about 23 million years ago) [33]. The Mesohellenic Trench is divided into two geographic and geological units: the basin of Grevena and the basin of Kalambaka-Trikala. Different sedimentary facies encountered in the molassic deposits facilitate the discrimination of stratigraphic units (formations) within the Mesohellenic Trench [34] (Figures 1 and 2).

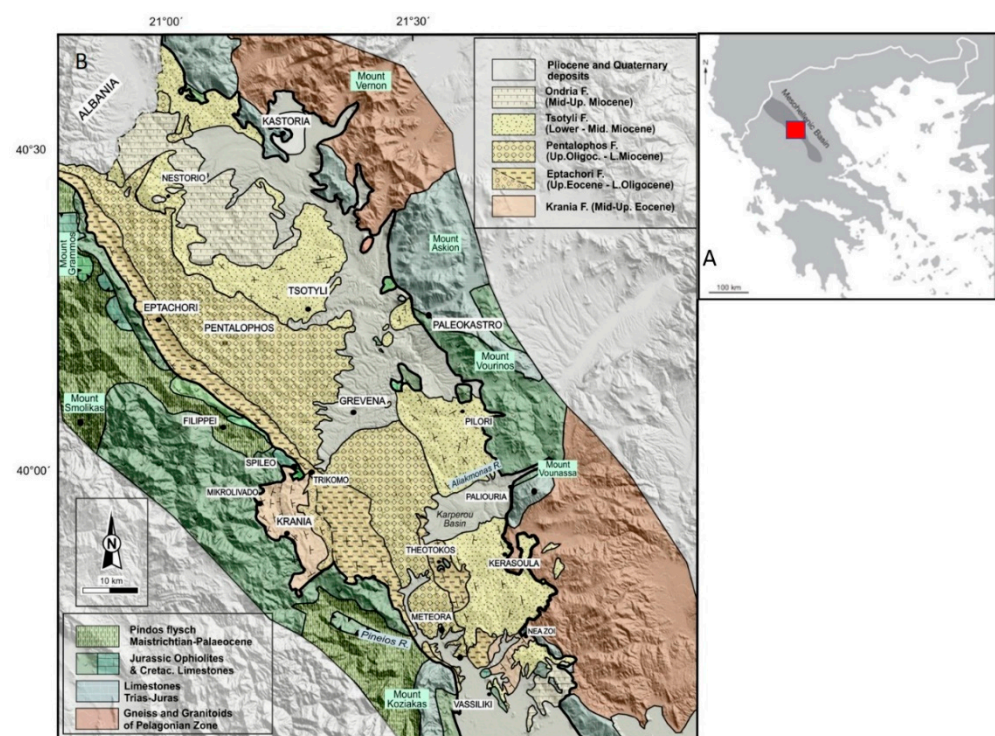


Figure 1. (A) A schematic sketch map of Greece indicating the location of the Mesohellenic Basin, (B) Stratigraphic sequences of the Mesohellenic Trench and the surrounding basement units (modified after [34–36]).

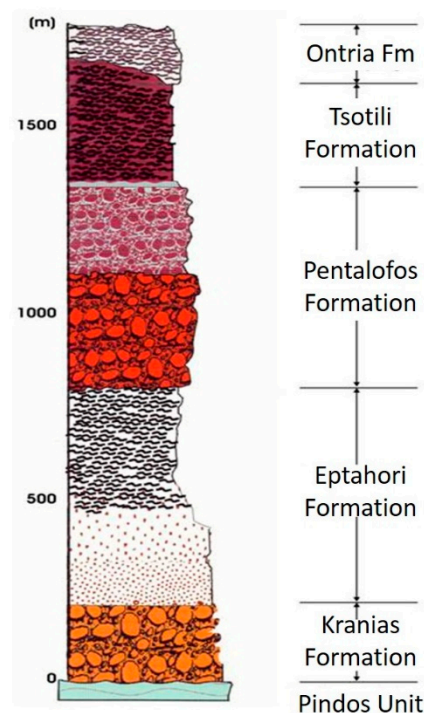


Figure 2. Indicative stratigraphic column of the “Formations” of the Mesohellenic Trench [33]. The sediments of the “Kranias Formation” comprise upper Eocene conglomerates and marls at the base, while the upper part is characterized by alternations of sandstones with marls. The Eptahori Formation comprises upper Oligocene marine sediments with some intervals of fluvial origin. The early Miocene Tsotili Formation is composed of conglomerates passing upwards to marine marls and sandy marls. The deposition of Ontria or the Katanochori Kastoria Formation took place in Burdigalian and consists of sandstones, limestones, marls and clastic limestones. Lignite layers are identified in the upper parts of the formation. Finally, the Orlia Formation was deposited during the Middle Miocene and consists of sandstones and biogenic limestones.

The Meteora Geomorphes belong to the “Pentalophos Formation,” which stretches at least from the Albanian border to the Thessalian draft. The maximum thickness of the formation sediments is about 4000 m. The sediments are essentially of marine origin however have been accepted as fluvial and terrestrial material, and therefore there is a high turnover of sediments in this formation. The sediments of the formation change laterally to Meteora conglomerates.

The stratigraphic succession of the Meteora conglomerates includes the Lower Meteora Conglomerates (LMC, composed of fan-deltas) and the Upper Meteora Conglomerates (UMC, composed of dominantly fluvial deposits in this area) [37–42]. The conglomerates were deposited in a Gilbert-type deltaic system, where large channels occurred, entrenched vertically to the progression axis of the delta. The main units of sedimentary deposits recognized in Meteora conglomerate are: (a) wedge type deposits that are regarded as those deposited in coastal environments and interpreted under the “Gilbert-type” Delta model and (b) channel-type deposits that are regarded as those created during the basic level lowering or during the upward movement of the feeding source. The formation of Meteora landforms is due to: (a) tectonic events, (b) erosion due to flowing water and, (c) to a smaller extent, aeolic erosion. However, the tectonic activity associated with subduction processes had a significant impact on the formation and distribution of the Meteora conglomerates, according to sedimentological and structural evidence (Figure 3).

Meteora, besides its unique geological importance and rare ecosystem types, is also holding an exceptional cultural role in the region. The unique geological beauty, which has inspired people’s imagination to compare the original landforms to old and abandoned towers amongst the neighboring green mountains and various other myths about their

creation [43]. Furthermore, it is also an important monument for religion, and for all these reasons, the site of Meteora has been described by UNESCO as a mixed cultural and natural site of World Cultural Heritage [44]. The area of Meteora along with the Antihasia Mountains are included in the European network of protected areas NATURA 2000 with code GR1440003, which is the main European means for the conservation of natural habitats, wild fauna and flora.



Figure 3. The conglomerates of Meteora.

The Monasteries of Meteora, imbued with religious meaning, are part of the landscape that is an organically evolved environment that contains physical and cultural heritage values [45]. The first anchorites and hermits, according to historians, climbed to the rocks of Meteora at the end of the 11th and early 12th century and constituted a rudimentary ascetic state living in slots formed by rock crevices, following a unique ascetic lifestyle, which harmonized with nature. The geological structure of Meteora, as well as the unique morphology determined by it, produced conditions for monks to build monasteries [46]. The first systematic monastic community was organized on the *Great Meteoro*, in the 14th century, by Saint *Athanasios Meteorites*. In the 15th century, during the restoration of the ideal of seclusion, the monks built monasteries (Figure 4), and 24 of these monasteries were built during the time of the great revival of the eremitic ideal, facing tremendous difficulties [33]. Today, the monasteries on these ‘columns of the sky’ are the biggest and most important group of monasteries in Greece after those in Mount Athos, with an important contribution to the cultural heritage at a local, national and global level.

Today, a great part of the monasteries (“katholika” or the main churches of monasteries, cells, other buildings) have been either restored or are being restored. The most important engineering geological problems are related to the stability of the rocky cliffs and the stability of the monasteries, along with weathering, which is also an important cause of damage to the masonry. Despite the significance of protection measures, however, the region is currently under particular pressure arising from the constantly increasing number of tourists visiting the area, construction works (roads, installation of mobile infrastructure, etc.) [43] and also from uncontrolled urbanization of the surrounding natural area [47].



Figure 4. Meteora: A combination of cultural and geological components.

3. Materials and Methods

A research strategy of quantitative research is followed, with the characteristics of Evaluation Research, since it involves the evaluation of the participants' perceptions of value in the subjects of the geoenvironment and geocultural heritage. Moreover, the strategy can be characterized as Action Research as it deals with problem identification with respect to environmental education and suggests improvement actions [48]. This is followed by a research planning of the Review technique using a questionnaire [49]. The questionnaire consists of two parts: (a) the Demographic and Suggested data part and (b) the Perceptions part (Appendix A).

The questionnaire's first part consisted of demographic aspects, such as gender, participation in Environmental Education and Cultural Programs (questions 1–6). The questions were based on geological knowledge and concepts familiar to all students (e.g., rocks formation, erosion and understanding of geologic time) (questions 7–9). In the 10th question, which was selected from the "Questionnaire: Geoethics in the Geosciences" by Silvia Peppoloni and Giuseppe Di Capua [50], participants were asked to declare the most important aspects that geoeducation should develop. One of the eight statements concerning respect for natural dynamics was removed because it was not understood by students.

The second part consists of a hundred and twenty-five (125) items of self-report on which the participants' declaration is based on a Likert scale (1–5) [51]. The perceptions of participants were examined in 17 categories of values and attitudes toward the geoenvironment in relation to their geocultural heritage understanding, geoethical attitude and the concept of sustainability.

The values and attitudes assessed that constitute the independent variables are: 01. aesthetic value, 02. cultural value, 03. archaeological value, 04. religious value, 05. spiritual value, 06. geological value, 07. ecological value, 08. anthropocentric value (attitude), 09. ecocentric value (attitude), 10. environmental apathy (attitude), meaning the lack of interest in environmental issues, 11. utilitarian value, 12. intrinsic value, 13. scientific value, 14. economic value, 15. geoethical value, 16. sustainable development and 17. UNESCO criteria, namely cultural criteria 1, 5 and 7 met Meteora to join in UNESCO's "Monuments of World Cultural Heritage" list [52]. The examination was conducted on the two categories of research participants: pupils and students. The survey involved 612 participants, of which 429 ($\approx 70\%$) were pupils, and 183 ($\approx 30\%$) were students. In total, 255 ($\approx 42\%$) were boys and 357 ($\approx 58\%$) girls.

All descriptive elements and data based on participants' responses, together with the reliability coefficient (Cronbach Alpha) for each ecological value of geoethics, are shown in Table 1. It is noted that in most values, Cronbach Alpha receives values that can be characterized from Acceptable (>50) to Good (>80). The statements of the variable 17. *UNESCO criteria* are characterized by low reliability ($\alpha = 0.40$), but this, according to us, does not diminish the importance of its examination. Finally, it is noted that the Significance Level is predefined as equal to 05 and the Confidence Interval as equal to 95.0%.

Table 1. Descriptive Statistics and Reliability.

Values	Questions Number	n	M	SD	α
01. Aesthetic value	Q011.2, Q012.6, Q013.6, Q018, Q025	5	3.65	0.66	0.71
02. Cultural value	Q011.4, Q011.5, Q012.3, Q014.2, Q014.3, Q014.4, Q014.5, Q016, Q017, Q020, Q034, Q035, Q037	13	3.41	0.45	0.78
03. Archaeological value	Q011.4, Q012.3, Q014.2, Q014.3, Q014.4, Q020, Q036	7	3.41	0.78	0.90
04. Religious value	Q011.1, Q012.2, Q014.1, Q014.5, Q037	5	3.92	0.67	0.73
05. Spiritual value	Q011.1, Q013.1, Q013.2, Q014.1, Q019	5	3.08	0.87	0.88
06. Geological value	Q011.3, Q012.4, Q013.4, Q013.5, Q014.6, Q015, Q017, Q021, Q024, Q025, Q026, Q027, Q028, Q029, Q030, Q031, Q033, Q034, Q035, Q038, Q039, Q040	22	2.77	0.48	0.80
07. Ecological value	Q012.5, Q013.3, Q038, Q039	4	2.66	0.80	0.86
08. Anthropocentric value	Q028, Q029, Q030, Q031, Q057, Q058, Q059, Q060	8	3.68	0.67	0.73
09. Ecocentric value	Q024, Q025, Q026, Q027	4	2.19	0.73	0.58
10. Environmental apathy	Q011.6, Q033, Q034, Q035	4	1.89	0.87	0.83
11. Utilitarian value	Q028, Q029, Q030, Q031, Q057, Q058, Q059, Q060	8	3.68	0.67	0.73
12. Intrinsic value	Q024, Q025, Q026, Q027	4	2.19	0.73	0.58
13. Scientific value	Q022, Q023	2	3.10	1.03	0.85
14. Economic value	Q012.1, Q024, Q028, Q029, Q031, Q042, Q048, Q053	8	3.42	0.58	0.61
15. Geoethical value	Q029, Q041, Q042, Q043, Q044, Q045, Q047, Q048, Q057, Q058, Q059, Q060	12	3.70	0.49	0.64
16. Sustainable development	Q046, Q048, Q049, Q050, Q051, Q052, Q053, Q057, Q058, Q059, Q060	11	3.53	0.55	0.69
17. UNESCO criteria	Q054, Q055, Q056	3	4.14	0.65	0.40

4. Results

Statistics were carried out for demographic, suggested and perceptions data. The summarized data per question of questionnaire are presented in Appendix B.

4.1. Demographic and Suggested Data

The part of the Demographic and Suggested Data is synthesized from 10 first-level items or 35 items (first and second level). From the declarations of the 612 participants to the corresponding items of the investigation, it was discovered that:

1. Referring to their participation in Environmental or Cultural Educational Programs:
 - a. In total, 207 ($\approx 33\%$) have participated in a School Environmental Education Program; 123 pupils ($\approx 28.5\%$) and 84 students ($\approx 46\%$).

- b. In total, 147 have participated in a school Cultural Program ($\approx 23.5\%$); 69 pupils ($\approx 16\%$) and 78 students ($\approx 42\%$).
 - c. In total, 129 have participated in an Environmental Education Program for another body to ($\approx 21\%$); 66 pupils ($\approx 15.5\%$) and 63 students ($\approx 34.5\%$).
 - d. In total, 225 have not participated in an Environmental Education Program or Cultural Program ($\approx 36\%$); 210 pupils ($\approx 49\%$) and 15 students ($\approx 8\%$).
2. In total, 603 (98.5%) knew the area of Meteora, and 9 ($\approx 1.5\%$) did not.
3. In total, 456 ($\approx 74.5\%$) had visited the Meteora region, and 156 ($\approx 25.5\%$) had not visited it.
4. Their basic acquaintance with Meteora took place:
 - a. In a history lesson for 69 ($\approx 11\%$) of these.
 - b. In a Geology–Geography lesson for 318 ($\approx 51\%$) of them.
 - c. In a religion lesson for 339 ($\approx 54\%$) of these.
 - d. In a literature lesson for 24 ($\approx 4\%$) of these.
 - e. In a different activity (such as a lesson, educational excursion, personal interest, etc.) or not at all for 87 ($\approx 14\%$) of them.
5. Participants, in the question regarding the origin of the Meteora rocks, replied:
 - a. In total, 126 ($\approx 20.5\%$) replied that they are volcanic rocks formed by the solidification of lava after a volcanic eruption.
 - b. In total, 102 ($\approx 16.5\%$) replied that they are rocks formed from a material that has settled in the water.
 - c. In total, 30 ($\approx 5\%$) replied that they came from meteorites.
 - d. In total, 84 (≈ 14) replied that they were formed by rock landslides.
 - e. In total, 270 ($\approx 44\%$) replied that they resulted from the erosion of the coasts by the sea waters that existed in the area millions of years ago.
6. Participants, in the question regarding the understanding of the geological time formation of the Meteora rocks, replied:
 - a. In total, 198 ($\approx 32.5\%$) replied that they were formed during thousands of years.
 - b. In total, 27 ($\approx 4.5\%$) replied that they were formed during a few decades.
 - c. In total, 249 ($\approx 40.5\%$) replied that they were formed during millions of years.
 - d. In total, 102 ($\approx 16.5\%$) replied that they were formed during hundreds of years.
 - e. In total, 36 ($\approx 6\%$) replied that they were formed during a few days.
7. Participants, in the question about geological erosion time of the Meteora rocks, and in particular when they think the rocks of Meteora will begin to erode, replied:
 - a. In total, 273 ($\approx 44.5\%$) replied that they are already eroding.
 - b. In total, 84 ($\approx 13.5\%$) replied in tens of years.
 - c. In total, 102 ($\approx 16.5\%$) replied in hundreds of years.
 - d. In total, 84 ($\approx 13.5\%$) replied in thousands of years.
 - e. In total, 69 ($\approx 11\%$) replied in millions of years.
8. Finally, in the item for the expression of their opinion on the most important aspects that geoeducation has to develop, participants suggested:
 - a. 213 ($\approx 34\%$) the geoscientific knowledge;
 - b. 336 ($\approx 54\%$) the awareness about hazards;
 - c. 375 ($\approx 60\%$) the responsible use of geo-resources;
 - d. 162 ($\approx 26\%$) the capacity in sustainable approaches;
 - e. 234 ($\approx 38\%$) the capability for risk mitigation;
 - f. 408 ($\approx 66\%$) the value of environmental heritage and geoheritage;
 - g. 231 ($\approx 37\%$) the importance of geosciences for daily life.

4.2. Perceptions Data

Normality test was performed on the variables of the Values of the Pupils team and the Students team. The test was performed based on the *Kolmogorov–Smirnov and Shapiro–Wilk*

statistical tests. In neither of the two groups was a Value variable identified whose results approached Normal Distribution. Thus, the statistical tests followed Non-Parametric techniques. It is also noted the presence of an insignificant number of extreme values (<0.5%) which do not prevent the export of reliable results.

A comparative approach was performed between the data of the categories (groups) of participants, i.e., the group of Pupils ($N = 429$, $\approx 70\%$) and the group of Students ($N = 183$, $\approx 30\%$). Our interest concerns the comparison of the variables of Values in the groups and especially of their Means and the Skewness of the distribution relative to the Means. This interest is due to the fact that the mean value and asymmetry of our distribution provide information in relation to the value trends and attitudes of the participants in each of the Values variables that are examined (Table 2).

Table 2. Statistics: descriptive, relation to the spread of the distribution and estimation.

Value	Population	M(SD)	Skew	Relation to the Spread of the Distribution	Estimation (Demonstration of...)
01. Aesthetic value	Pupils	3.59 (0.68)	-0.60	moderately right with high asymmetry to the right	...quite high Aesthetic value
	Students	3.82 (0.61)	-0.63	moderately right with high asymmetry to the right	...quite high Aesthetic value
02. Cultural value	Pupils	3.31 (0.45)	-0.07	slightly right with medium asymmetry to the right	...moderate Cultural value
	Students	3.65 (0.36)	-0.98	moderately right with very high asymmetry to the right	...quite high Cultural value
03. Archaeological value	Pupils	3.19 (0.77)	-0.55	close (right) to center with high asymmetry to the right	...quite high Archaeological value
	Students	3.93 (0.48)	-0.20	moderately right with medium-high asymmetry to the right	...quite high Archaeological value
04. Religious value	Pupils	4.01 (0.64)	-0.99	moderately right with very high asymmetry to the right	...moderate high Religious value
	Students	3.73 (0.69)	-0.83	moderately right with very high asymmetry to the right	...quite high Religious value
05. Spiritual value	Pupils	3.20 (0.94)	0.51	close (right) to center with low asymmetry to the left	...moderate Spiritual value
	Students	2.81 (0.68)	0.97	close (left) to center with very low asymmetry to the left	...moderate Spiritual value
06. Geological value	Pupils	2.84 (0.47)	0.48	close (left) to center with low asymmetry to the left	...moderate Geological value
	Students	2.62 (0.48)	0.98	slightly left with very low asymmetry to the left	...slightly low Geological value
07. Ecological value	Pupils	2.83 (0.76)	-0.19	close (left) to center with medium-high asymmetry to the right	...slightly low Ecological value
	Students	2.27 (0.76)	0.47	moderately left with low asymmetry to the left	...quite low Ecological value
08. Anthropocentric value	Pupils	3.83 (0.61)	-0.70	moderately right with high asymmetry to the right	...quite high Anthropocentric value
	Students	3.33 (0.66)	-0.33	slightly right with medium-high asymmetry to the right	...slightly high Anthropocentric value
09. Ecocentric value	Pupils	2.29 (0.75)	0.32	moderately left with medium-low asymmetry to the left	...quite low Ecocentric value
	Students	1.97 (0.60)	0.40	moderately left with medium-low asymmetry to the left	...quite low Ecocentric value
10. Environmental apathy	Pupils	2.01 (0.86)	0.55	moderately left with low asymmetry to the left	...quite low Environmental apathy
	Students	1.58 (0.82)	0.99	significantly left with very low asymmetry to the left	...significantly low Environmental apathy
11. Utilitarian value	Pupils	3.83 (0.61)	-0.70	moderately right with high asymmetry to the right	...quite high Utilitarian value
	Students	3.33 (0.66)	-0.33	slightly right with medium-high asymmetry to the right	...slightly high Utilitarian value
12. Intrinsic value	Pupils	2.29 (0.75)	0.32	moderately left with medium-low asymmetry to the left	...quite low Intrinsic value
	Students	1.97 (0.60)	0.40	moderately left with medium-low asymmetry to the left	...quite low Intrinsic value

Table 2. Cont.

Value	Population	M(SD)	Skew	Relation to the Spread of the Distribution	Estimation (Demonstration of...)
13. Scientific value	Pupils	3.18 (1.05)	−0.02	close (right) to center with no asymmetry to the right	...moderate Scientific value
	Students	2.93 (0.97)	0.14	close (left) to center with medium asymmetry to the left	...moderate Scientific value
14. Economic value	Pupils	3.44 (0.56)	−0.22	slightly right with medium-high asymmetry to the right	...slightly high Economic value
	Students	3.39 (0.62)	−0.07	slightly right with medium asymmetry to the right	...slightly high Economic value
15. Geoethical value	Geoethical value is examined in the following Table 3				
16. Sustainable development	Sustainable development is examined in the following Table 4				
17. UNESCO criteria	Pupils	4.14 (0.69)	−0.88	moderately right with very high asymmetry to the right	...moderate high UNESCO criteria
	Students	4.16 (0.57)	−0.70	significantly right with high asymmetry to the right	...moderate high UNESCO criteria

This was followed by a comparison between the distributions of the answers of the two groups: *Pupils and Students (Status)*. The non-parametric *Mann–Whitney U* test was used. It was assumed that all observations from both groups were independent of each other, and the answers were normal. The null hypothesis H_0 that the distributions of both populations are equal, and the alternative hypothesis H_1 that the distributions are not equal was determined. The test showed the following:

01. *Aesthetic value across Status* (Figure 5a). Aesthetic value scores of Pupils ($M_{dN} = 3.6$) were lower than those of Students ($M_{dN} = 3.8$). P value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 46,996.00$, $z = 3.885$, $p < 0.05$. 02. *Cultural value across Status* (Figure 5b). Cultural value scores of Pupils ($M_{dN} = 3.3$) were lower than those of Students ($M_{dN} = 3.7$). P value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 56,842.00$, $z = 8.798$, $p < 0.05$. 03. *Archaeological value across Status* (Figure 5c). Archaeological value scores of Pupils ($M_{dN} = 3.2$) were lower than those of Students ($M_{dN} = 3.9$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 62,191.0$, $z = 1993.713$, $p < 0.05$.

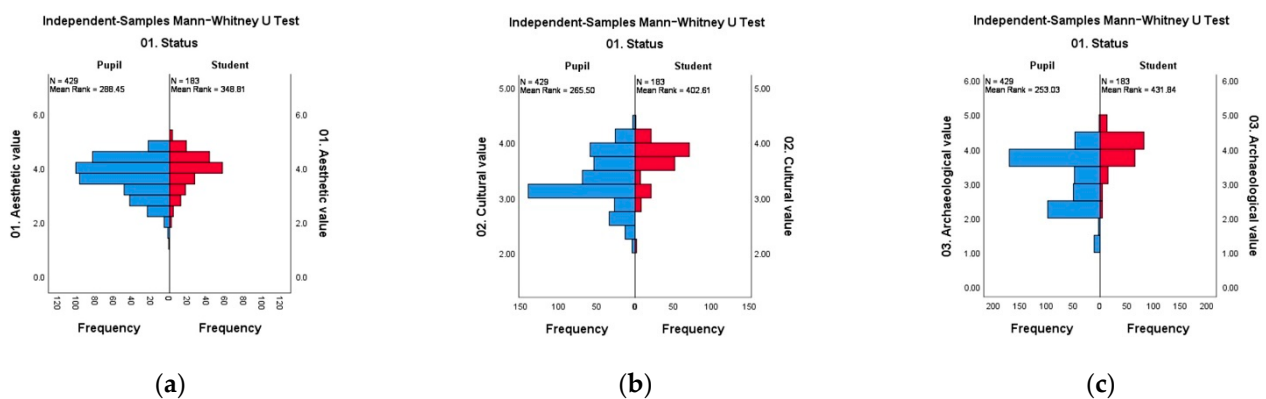


Figure 5. (a) The Aesthetic value across Status. (b) The Cultural value across Status. (c) The Archaeological value across Status.

04. *Religious value across Status* (Figure 6a). Religious value scores of Pupils ($M_{dN} = 4.0$) were greater than those of Students ($M_{dN} = 3.7$). P value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null

hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 28,815.00$, $z = -5.250$, $p < 0.05$. 05. *Spiritual value across Status* (Figure 6b). Spiritual value scores of Pupils ($M_{dN} = 3.2$) were greater than those of Students ($M_{dN} = 2.8$). p value found Sig. = $0.00 < 0.05$, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 30,288.00$, $z = -4.499$, $p < 0.05$. 06. *Geological value across Status* (Figure 6c). Geological value scores of Pupils ($M_{dN} = 2.8$) were greater than those of Students ($M_{dN} = 2.6$). p value found Sig. = $0.00 < 0.05$, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 27,097.00$, $z = -6.074$, $p < 0.05$.

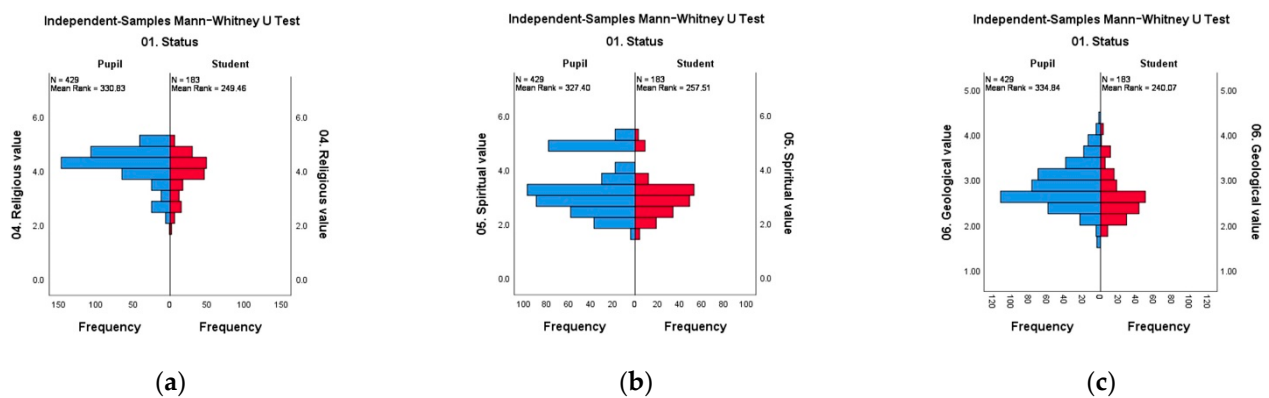


Figure 6. (a) The Religious value across Status. (b) The Spiritual value across Status. (c) The Geological value across Status.

07. *Ecological value across Status* (Figure 7a). Ecological value scores of Pupils ($M_{dN} = 2.8$) were greater than those of Students ($M_{dN} = 2.3$). p value found Sig. = $0.00 < 0.05$, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 22,911.00$, $z = -8.250$, $p < 0.05$. 08. *Anthropocentric value across Status* (Figure 7b). Anthropocentric value scores of Pupils ($M_{dN} = 3.8$) were greater than those of Students ($M_{dN} = 3.3$). p value found Sig. = $0.00 < 0.05$, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 22,330.00$, $z = -8.465$, $p < 0.05$. 09. *Ecocentric value across Status* (Figure 7c). Ecocentric value scores of Pupils ($M_{dN} = 2.3$) were greater than those of Students ($M_{dN} = 2.0$). p value found Sig. = $0.00 < 0.05$, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 29,847.00$, $z = -4.741$, $p < 0.05$.

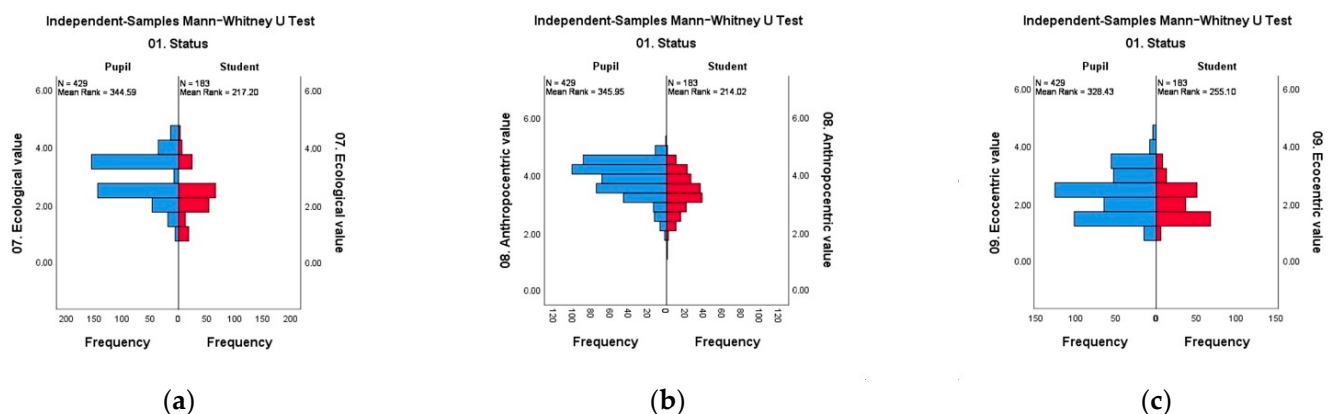


Figure 7. (a) The Ecological value across Status. (b) The Anthropocentric value across Status. (c) The Ecocentric value across Status.

10. *Environmental apathy across Status* (Figure 8a). Environmental apathy scores of Pupils ($M_{dN} = 2.0$) were greater than those of Students ($M_{dN} = 1.6$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 26,622.00, z = -6.405, p < 0.05$. 11. *Utilitarian value across Status* (Figure 8b). Utilitarian value scores of Pupils ($M_{dN} = 3.9$) were greater than those of Students ($M_{dN} = 3.3$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 22,330.00, z = -8.465, p < 0.05$. 12. *Intrinsic value across Status* (Figure 8c). Intrinsic value scores of Pupils ($M_{dN} = 2.3$) were greater than those of Students ($M_{dN} = 2.0$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 29,847.00, z = -4.741, p < 0.05$.

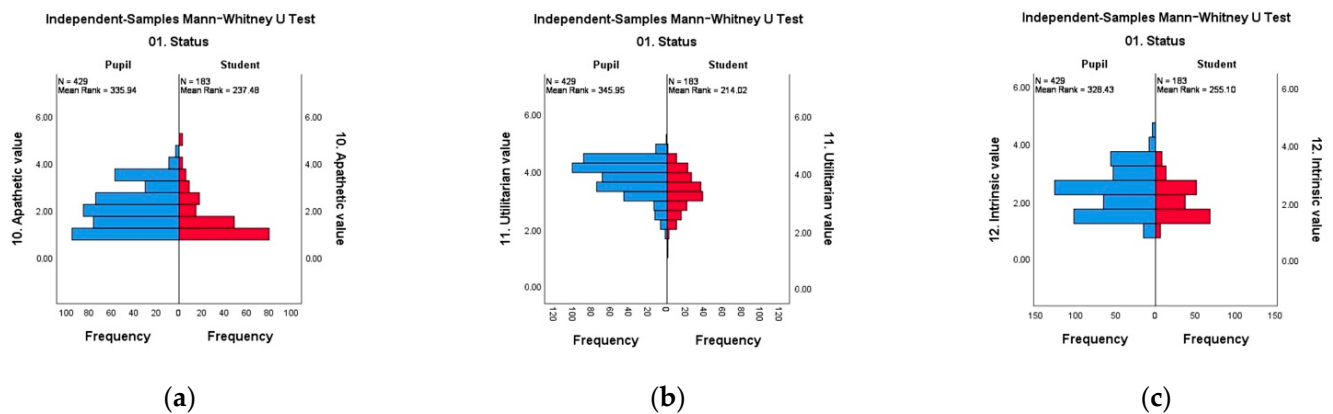


Figure 8. (a) The Environmental apathy across Status. (b) The Utilitarian value across Status. (c) The Intrinsic value across Status.

13. *Scientific value across Status* (Figure 9a). Scientific value scores of Pupils ($M_{dN} = 3.2$) were greater than those of Students ($M_{dN} = 2.9$). p value found Sig. = 0.007 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 33,889.500, z = -2.705, p < 0.05$. 14. *Economic value across Status* (Figure 9b). Economic value scores of Pupils ($M_{dN} = 3.4$) were equal to those of Students ($M_{dN} = 3.4$). p value found Sig. = 0.364 > 0.05, the test indicated that this difference was statistically non-significant, and the decision was: Retain the null hypothesis (the distributions are the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 37,440.500, z = -0.907, p > 0.05$. 15. *Geoethical value across Status* (Figure 9c). Geoethical value scores of Pupils ($M_{dN} = 3.75$) were greater than those of Students ($M_{dN} = 3.58$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 32,206.00, z = -3.524, p < 0.05$.

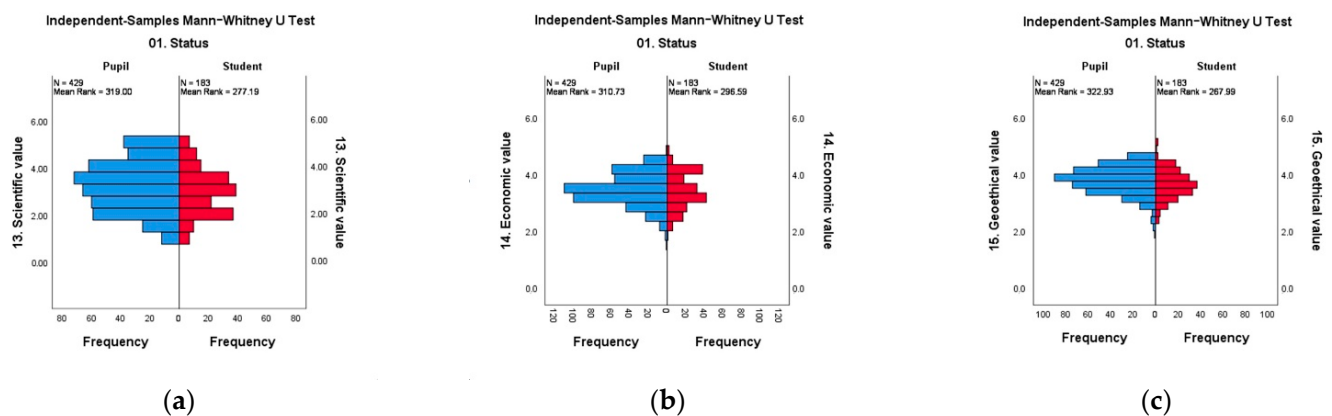


Figure 9. (a) The Scientific value across Status. (b) The Economic value across Status. (c) The Geoethical value across Status.

16. *Sustainable development across Status* (Figure 10a). Sustainable development scores of Pupils ($M_{dN} = 3.6$) were greater than those of Students ($M_{dN} = 3.3$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 24,810.00$, $z = -7.222$, $p < 0.05$. 17. *UNESCO criteria across Status* (Figure 10b). UNESCO criteria scores of Pupils ($M_{dN} = 4.3$) were equal to those of Students ($M_{dN} = 4.3$). p value found Sig. = 0.702 > 0.05, the test indicated that this difference was statistically non-significant, and the decision was: Retain the null hypothesis (the distributions are the same), $U(N_{Pupils} = 429, N_{Students} = 183) = 38,497.500$, $z = -0.383$, $p > 0.05$.

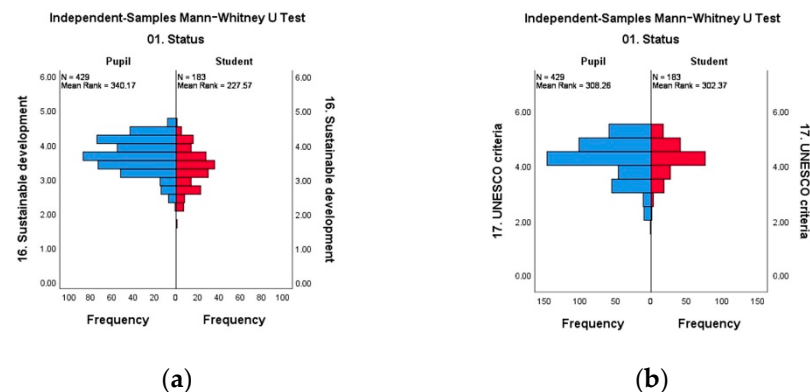


Figure 10. (a) Sustainable development across. (b) UNESCO criteria across Status.

A comparative approach was performed between the data of the categories [groups] of participants, i.e., the group of those who have participated in educational programs of Environmental or Cultural object with the characterization *Participation* ($N = 387$, $\approx 63\%$) and those who do not have as *Non-Participation* ($N = 225$, $\approx 37\%$). Our interest concerns the comparison of the variables of the Values in the groups and especially of the Means and the Skewness of their distribution regarding their average value. The following descriptive statistical results are obtained for Values 02. *Cultural value*, 06. *Geological value*, 15. *Geoethical value* and 16. *Sustainable development*, in relation to the categories Participation and Non-Participation:

02. *Cultural value*. Regarding the Non-Participation group, based on the fact that the Mean was 3.35 (0.48) and the Median was 3.31 (which means that they are in a position close to the middle and right of the middle of the scale (1–5)), we conclude that Non-Participation participants seem to display a significant degree of Cultural value. The same can be deduced from the Skewness value of -0.10 , which shows the asymmetry of the distribution of their answers to the right, i.e., to the medium to large values of the Cultural value response scale. Regarding the Participation team considering the Cultural value

based on the fact that the Mean was 3.44 (0.42), but also the Median was 3.54 (which means that they are in a position close to the middle and to the right of the middle of the scale (1–5)), we conclude that the Participation participants seem to display a significant degree of Cultural value. The same can be deduced from the value of Skewness of -0.57 , which shows asymmetry of the distribution of their answers to the right, i.e., to the large values of the scale of answers of Cultural value.

06. Geological value. Regarding the Non-Participation group examining the Geological value based on the fact that the Mean was 2.93 (0.48) and the Median was 2.86 (which means that they are in a position close to the middle of the scale (1–5)), we conclude that Non-Participation participants seem to show an average degree of Geological value. The same can be deduced from the Skewness value of 0.47, which shows the asymmetry of the distribution of their answers to the left, i.e., to the small values of the Geological value response scale.

Regarding the Participation group, based on the fact that the Mean was 2.68 (0.46) and the Median was 2.59 (which means that they are in a position close to the middle and left of the middle of the scale (1–5)), we conclude that Participation participants seem to exhibit a rather low degree of Geological value. The same can be deduced from the Skewness value of 0.75, which shows the asymmetry of the distribution of their answers to the left, i.e., to the small values of the Geological value response scale.

15. Geoethical value. Regarding the Non-Participation group examining the Geoethical value based on the fact that the Mean was 3.81 (0.51) and the Median was 3.83 (which means that they are in a position to the right of the middle of the scale (1–5)), we conclude that Non-Participation participants seem to exhibit a significant degree of Geoethical value. The same can be deduced from the Skewness value of -0.32 , which shows the asymmetry of the distribution of their answers to the right, i.e., to the medium to large values of the Geoethical value scale.

Regarding the Participation group examining the Geoethical value based on the fact that Mean was 3.64 (0.47) and Median was 3.67 (which means that they are in a position to the right of the middle of the scale (1–5)), we conclude that Participation participants seem to display a significant degree of Geoethical value. The same can be deduced from the Skewness value of -0.52 , which shows the asymmetry of the distribution of their answers to the right, i.e., to the large values of the Geoethical value response scale.

16. Sustainable development. Regarding the Non-Participation group, based on the fact that the Mean was 3.70 (0.53) and the Median was 3.73 (which means that they are in a position to the right of the middle of the scale (1–5)), we conclude that Non-Participation participants seem to exhibit a significant degree of Sustainable development. The same can be deduced from the Skewness value of -0.39 , which shows the asymmetry of the distribution of their answers to the right, i.e., to the medium to large values of the Sustainable development response scale.

Regarding the Participation team considering Sustainable development based on the fact that the Mean was 3.43 (0.53), but also the Median was 3.45 (which means that they are in a position close to the middle and to the right of the middle of the scale (1–5)), we conclude that Participation participants seem to show a significant degree of Sustainable development. The same can be deduced from the Skewness value of -0.40 , which shows the asymmetry of the distribution of their answers to the right, i.e., to the medium to large values of the Sustainable development response scale.

Then, the distributions of the answers of the two groups (Participations and Non-Participations) were compared. Due to the non-parametric distributions in all the variables of the Values, in order to compare these distributions, the non-parametric *Mann-Whitney U* test was used. It was assumed that all observations from both groups were independent of each other, and the answers were normal. The null hypothesis H_0 that the distributions of both populations are equal and the alternative hypothesis H_1 that the distributions are not equal were determined. The test (Significance level: 0.05, Confidence interval: 95.0%) showed the following:

02. Cultural value across Educational Programs Participation (Figure 11a). Cultural value scores of the Participation group ($M_{dN} = 3.6$) were lower than those of Non-Participation ($M_{dN} = 3.8$). p value found Sig. = 0.020 < 0.05, the test indicated that this difference was sta-

tistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Participation} = 387, N_{Non-Participation} = 225) = 48,434.500, z = 2.326, p < 0.05$.

06. *Geological value across Educational Programs Participation* (Figure 11b). Geological value scores of the Participation group ($M_{dN} = 3.31$) were lower than those of Non-Participation ($M_{dN} = 3.54$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Participation} = 387, N_{Non-Participation} = 225) = 29,490.00, z = -6.664, p < 0.05$.

15. *Geoethical value across Educational Programs Participation* (Figure 11c). Geoethical value scores of Participation ($M_{dN} = 2.86$) were lower than those of Non-Participation ($M_{dN} = 2.59$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Participation} = 387, N_{Non-Participation} = 225) = 34,644.00, z = -4.223, p < 0.05$.

16. *Sustainable development across Educational Programs Participation* (Figure 11d). Sustainable development scores of the Participation group ($M_{dN} = 3.83$) were lower than those of Non-Participation ($M_{dN} = 3.67$). p value found Sig. = 0.00 < 0.05, the test indicated that this difference was statistically significant, and the decision was: Reject the null hypothesis (the distributions are not the same), $U(N_{Participation} = 387, N_{Non-Participation} = 225) = 31,731.00, z = -5.605, p < 0.05$.

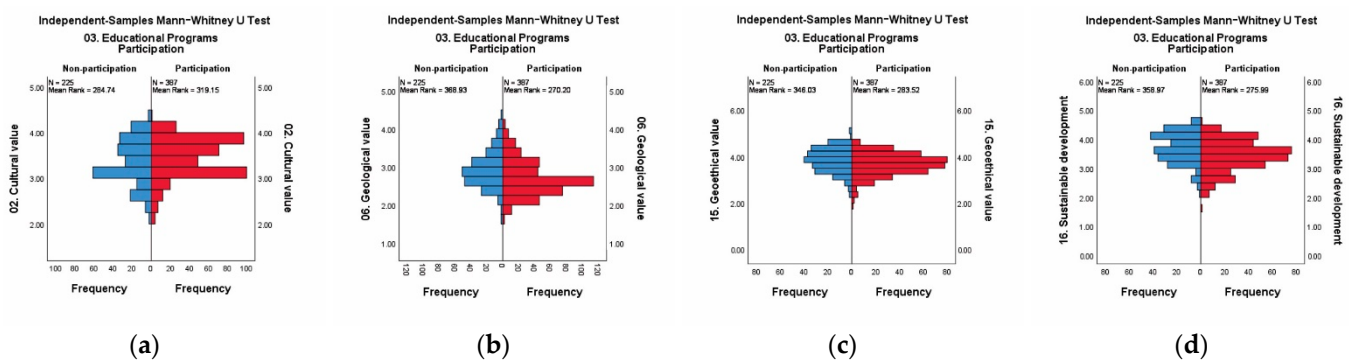


Figure 11. (a) The Cultural value across Educational Programs Participation. (b) The Geological value across Educational Programs Participation. (c) The Geoethical value across Educational Programs Participation. (d) Sustainable development across Educational Programs Participation.

Specific descriptive statistics of the *Geoethical value* (Table 3) and *Sustainable development* (Table 4) were then examined.

Table 3. Statistics: descriptive, relation to the spread of the distribution and estimation of perceptions of Geoethical value items.

Item (Question)	M (SE)	SD	Skew	Result (Relative to the Spread of the Distribution)	Their Perception Seems to Be ...
Q029. It is perfectly understandable that the monks and local businessmen of Meteora are interested in the development of tourism and the coverage of their financial needs and not in any impact on the environment.	3.18 (0.05)	1.25	−0.24	close (right) to centre with medium-high asymmetry to the right	...moderate
Q041. It is perfectly understandable that the inhabitants of the Meteora area react negatively to the imposition of restrictions on the use of their land.	3.36 (0.05)	1.15	−0.21	slightly right with medium-high asymmetry to the right	...slightly high
Q042. It is natural that local businessmen and monks of Meteora do not agree with the restriction of the flow of tourists because their incomes will decrease	3.79 (0.04)	1.07	−0.56	moderately right with high asymmetry to the right	...quite high

Table 3. Cont.

Item (Question)	M (SE)	SD	Skew	Result (Relative to the Spread of the Distribution)	Their Perception Seems to Be ...
Q043. The protection and conservation measures of Meteora must be observed by all interested parties (monastic community, municipal authority, visitors)	4.28 (0.04)	0.94	−0.99	significantly right with very high asymmetry to the right	...moderate high
Q044. It makes me sad that no measures are taken to regulate the flow of tourists in order to protect the spiritual character of the place and the environment	4.12 (0.04)	0.92	−0.99	moderately right with very high asymmetry to the right	...moderate high
Q045. I believe that the natural values of Meteora should impose strict restrictions on the activities of the locals	3.25 (0.05)	1.13	−0.06	slightly right with medium asymmetry to the right	...slightly high
Q047. There are teachers who encourage their students to collect fossils during educational visits to Meteora	3.07 (0.05)	1.19	0.01	close to centre with no asymmetry	...moderate
Q048. It is positive that in Meteora there is “more tourism—more money” because Meteora is part of a renewable social and natural capital	3.53(.04)	1.08	−0.43	slightly right with medium-high asymmetry to the right	...slightly high
Q057. Such additional constructions will help increase the number of tourists	3.58 (0.05)	1.10	−0.54	moderately right with high asymmetry to the right	...quite high
Q058. The addition of the new construction harmonizes with the monastery	3.80 (0.05)	1.14	−0.69	moderately right with high asymmetry to the right	...quite high
Q059. Additional constructions are necessary to serve the increased needs of the monks	3.72 (0.04)	1.04	−0.55	moderately right with high asymmetry to the right	...quite high
Q060. Such constructions contribute to the upgrade of the space	3.84 (0.04)	1.10	−0.69	moderately right with high asymmetry to the right	...quite high

Table 4. Statistics: descriptive, relation to the spread of the distribution and estimation of perceptions of Sustainable development Items.

Item (Question)	M (SE)	SD	Skew	Result (Relative to the Spread of the Distribution)	Their Perception Seems to Be ...
Q046. In the management of Meteora there must be a reasonable balance between the benefits of tourism and environmental costs	4.02 (0.04)	0.95	−0.83	moderately right with very high asymmetry to the right	...quite high
Q048. It is positive that in Meteora there is “more tourism—more money” because Meteora is part of a renewable social and natural capital	3.53 (0.04)	1.08	−0.43	slightly right with medium-high asymmetry to the right	...slightly high
Q049. The monks must be responsible for the construction of roads and their widening to facilitate visitors to the Monasteries	2.65 (0.05)	1.10	0.19	slightly left with medium-low asymmetry to the left	...slightly low
Q050. The detachment of rocks due to the creation of car parks is a necessary intervention to serve the visitors of Meteora	3.35 (0.05)	1.27	−0.31	slightly right with medium-high asymmetry to the right	...slightly high

Table 4. Cont.

Item (Question)	M (SE)	SD	Skew	Result (Relative to the Spread of the Distribution)	Their Perception Seems to Be ...
Q051. The opening of roads and the creation of car parks are necessary human interventions and do not reduce the value of the place	2.81 (0.05)	1.22	0.09	close (left) to centre with medium asymmetry to the left	...moderate
Q052. I do not understand why in the management of Meteora other bodies besides the monks should be involved (eg municipal authority)	3.51 (0.05)	1.20	−0.41	slightly right with medium-high asymmetry to the right	...slightly high
Q053. I fully understand that local entrepreneurs are interested in immediate economic benefits and not in a growth that will ultimately lead to greater profits in the long run	3.99 (0.04)	1.00	−0.80	moderately right with very high asymmetry to the right	...quite high
Q057. Such additional constructions will help increase the number of tourists	3.58 (0.05)	1.10	−0.54	moderately right with high asymmetry to the right	...quite high
Q058. The addition of the new construction harmonizes with the monastery	3.80 (0.05)	1.14	−0.69	moderately right with high asymmetry to the right	...quite high
Q059. Additional constructions are necessary to serve the increased needs of the monks	3.72 (0.04)	1.04	−0.55	moderately right with high asymmetry to the right	...quite high
Q060. Such constructions contribute to the upgrade of the space	3.84 (0.04)	1.10	−0.69	moderately right with high asymmetry to the right	...quite high

Finally, the correlations between the scores of specific Values are examined. The correlations between 02. *Cultural value*, 06. *Geological value*, 15. *Geoethical value* and 16. *Sustainable development* are examined. The non-parametric *Spearman's rho* coefficient test (Table 5) is used.

Table 5. Values correlations (*Spearman's rho* coefficient test).

		02. Cultural Value	06. Geological Value	15. Geoethical Value
06. Geological value	Correlation Coefficient	0.069		
	Sig. (2-tailed)	0.087		
15. Geoethical value	Correlation Coefficient	0.298 **	0.414 **	
	Sig. (2-tailed)	0.00	0.00	
16. Sustainable development	Correlation Coefficient	0.091 *	0.537 **	0.727 **
	Sig. (2-tailed)	0.025	0.00	0.00

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). c. Listwise $N = 612$.

It was found that there was (Table 5): no significant correlation between the 02. *Cultural value* and 06. *Geological value*, $r_s = 0.07$, $p = 0.09$, $N = 612$; a significant correlation (at the 0.01 level) between the 02. *Cultural value* and 06. *Geoethical value*, $r_s = 0.30$, $p = 0.00$, $N = 612$; a significant correlation (at the 0.05 level) between the 02. *Cultural value* and 16. *Sustainable development*, $r_s = 0.09$, $p = 0.03$, $N = 612$; a significant correlation (at the 0.01 level) between the 15. *Geological value* and 16. *Geoethical value*, $r_s = 0.41$, $p = 0.00$, $N = 612$; a significant correlation (at the 0.01 level) between the 06. *Geological value* and 16. *Sustainable development*, $r_s = 0.54$, $p = 0.00$, $N = 612$; a significant correlation (at the 0.01 level) between the 15. *Geoethical value* and 16. *Sustainable development*, $r_s = 0.73$, $p = 0.00$, $N = 612$.

5. Discussion

The results of the survey indicate that a significant number of pupils and students have participated in programs that promote culture and environmental education, mainly

through formal education. This reflects young people's interest and concerns about culture and environment, and in particular, their willingness to learn, since their participation in these programs is voluntary [53].

The majority of participants (pupils and students) know the Meteora region, and a large number have visited it. Fewer than half of participants seem to recognize geological characteristics of Meteora (rocks formation, erosion and understanding of geologic time [54].

5.1. Perception of Values

Both pupils and students perceive in a moderate degree the scientific value of geo-cultural heritage but recognize the need for geoeducation. Their opinion is interesting on important aspects that geoeducation has to develop. According to their preferences, a significant proportion of participants manifests their interest in the value of environmental heritage and geoheritage, the responsible use of geo-resources and the awareness about hazards. These results could help both in improving Geology–Geography cross-thematic course curriculum and textbooks and the enrichment of the environmental education's educational programs for sustainable development.

Both pupils and students perceive the aesthetic value of geodiversity contrary to geological value, which is perceived at a moderate degree from pupils and slightly low from students. These results were expected in terms of approaching the geological phenomenon because, according to the literature, high aesthetic appeal distracts from perceiving geological information [55]. Therefore, the landscape is not synonymous with landforms or geological structure, and often, geological elements are not recognized as predominantly [56]. A second factor that interprets geological value's moderate understanding is the incomplete geological knowledge offered by the Greek school about the natural geological environment [6].

The perception of participants for cultural values of geodiversity with its historical, archaeological and religious aspects seems to be generally high. Especially high enough is the archeological value followed in importance by religious and spiritual value to both pupils and students. This is confirmed to a certain extent as well from the satisfactory understanding of the Cultural Criteria who met Meteora in order to join UNESCO's "Monuments of World Cultural Heritage." This result was also expected because historical, cultural, natural or spectacular elements of a location are often imposed on geological features [57]. It is obvious by the statements of the participants of both pupils and students that in formal education, cultural values are projected and strengthened. Besides, these are values that the official state embraces and are recognized by the whole Greek society [58]. Great importance is given to anthropocentric and utilitarian values by pupils and students, with pupils in a quite higher degree than students. Moreover, all participants (pupils and students) perceive the economic value to a slightly higher degree. On the other hand, there is a very small degree of environmental apathy, especially to students about geoheritage protection and preservation. This means that young people are interested in the environment and that there is a good ground for exploiting the field of geoenvironmental education.

Unlike cultural, anthropocentric, utilitarian and economic values, pupils and students embrace to a quite low degree ecological, ecocentric and intrinsic values. It appears that pupils and students are not enclosed in a systemic, holistic and cross-thematic approach to the value of the geoenvironment in order to understand that ecosystems include both biotic and abiotic ingredients which interact and depend on each other.

Therefore, Geology–Geography course and environmental education, which both focus mainly on the acquisition of knowledge on the environment, is necessary to allow students to realize the ecological or natural process value because the value of geodiversity is important for the preservation of geological, geomorphic and territorial processes and the maintenance of biological processes that depend on natural systems [17]. In addition to the ecological value, students should understand the ecocentric sustainability dimension that attributes value to nature. This creates the conditions for expanding the moral concerns of

pupils even beyond living beings, namely recognition of geodiversity's intrinsic value [17], which is part of a non-renewable societal and natural capital [27].

5.2. Perception of Geoethical and Sustainable Development Values

Over geoethical values, we observe that participants perceive the need for protection measures in particular to the environment and spiritual character of the geosite and understand that the whole society must comply with these measures. However, they are in favor of the interests of local communities in the case of restrictions on the use of land, flow of tourists, even when they refer to their impact on the environment. These are ethical dilemmas in which values are in confrontation and are difficult to reconcile. In addition, they greatly realize the geosite as a renewable social and natural capital and that human interventions are necessary to serve increased needs.

Several of the reported statements of the participants for geoethical values apply as well as to sustainable development values. In addition, a fairly large percentage states that more tourism will bring more money, the detachment of rocks due to the creation of car parks is a necessary intervention to serve the visitors, the direct economic profit is preferable to a sustainable development that will lead to profits in the long run, and the management of the site does not need to involve other entities (e.g., municipal authority) other than the monks.

From the above statements, it seems that the participants do not support equally the three pillars of sustainability: society, economy and environment [59]. Additionally, their good functioning is the necessary condition for achieving. In other words, the perception dominating is that the natural environment is the subject-to-exploitation, aiming at satisfying human needs. For this students' education in an atmosphere of free and critical discussion [60], it must also include the teaching of specific values that establish sustainability by creating a moral set that shapes relations with the environment and other people. The awareness of their personal value context can lead to a possible amendment to the basis of the environmental and sustainability values and signal their transition to a higher state of moral thinking [61].

5.3. Differences in the Perception of Values between Pupils and Students

The ascertainment of disadvantage in perceptions between pupils and students in most values, although they show a similar tendency, is judged as important. The deepest perception of aesthetic, cultural and archaeological values in the case of students is attributed by researchers at the university education and education in the objects associated with these values. The high degree in other perceptions could also be attributed to the highest educational and emotional maturation in post-adolescent (university) age. This means over three years of high-level education and in educational objects of mainly humanitarian-social sciences (HASS).

It preoccupies the highest spiritual and especially scientific value in pupils instead of students. This can be related to the latest approaches to pupils than to students in this context. It is obvious that this distinct treatment of the issue is due to education levels, so dealing with these values is again restricted to the multilateral negotiation of the issues of values in the education system. However, in any case, it appears that more research is needed to explain these variations.

Significant correlations between geological, geoethical and sustainable development values do not come as a surprise. Based on this fact, this correlation augments the perception of the need to offer more geological knowledge to our students for the purpose of developing geoethics and sustainable development values. The non-correlation of cultural value with geological value essentially confirms the absence of deep geological knowledge to educational programs contrary to satisfactory knowledge development for culture.

Although the number of participants in this research is not small and according to sampling theories can explain a large population, this research is not enough to generalize its results. However, it can contribute to the realization of geoeducation's integration into

compulsory education and assist those who plan educational policy, authors of curricula and teachers.

5.4. Proposal for the Integration of Geoeducation into Environmental Education

Geoethics promotes geoeducation, and it can contribute to the understanding of values. The effective protection of the abiotic elements of the environment requires raising awareness among society [62], so that all citizens manage to behave in a geoethical manner. This requires the development of geoethical education [63] because it is essential for the students to develop an ethical code and a sense of responsibility for the protection and conservation of their environment [8]. We all agree that geology cannot be absent from the teaching of natural sciences [64] and that the prospect of growth of geological knowledge must be provided through the teaching of the Geology–Geography course but mainly through environmental education [4,9].

Environmental education with the integration of geoeducation and the strengthening of geological heritage with holistic approaches and interdisciplinary links is called upon to play an important role in promoting its values [65]. In this direction, geoscientists are called to promote geoeducation as a fundamental social value [66] so that students evolve into conscious and informed citizens and develop a sense of participation and management. Up to the present, geoenvironmental education is not included in school programs, although it should be at the heart of learning both in primary and secondary education in all thematic areas (Geography, History, Mathematics, Physics, etc.) and geoethics becomes the core of all courses of education [63].

The Contribution of STEM and HASS Objects to Geoenvironmental Education

Geological culture and geoethics can reinforce the bond that joins people with Earth and help to find solutions to the challenges [67] of the 21st century. In order to achieve geoenvironmental educational purpose, it is proposed to enrich the proposals, directives and detailed curricula in compulsory education with, Humanities, Arts and Social Sciences (HASS) objects.

Geoenvironmental problems require a holistic, interdisciplinary and cross-thematic educational approach, yet the concept of interdisciplinarity is subject to various interpretations and is usually limited to a choice of teaching activities in particular thematic areas of education accompanied by a relaxed teaching methodology. It is claimed that the adoption of STEM methodology (Science, Technology, Engineering and Mathematics) by geoenvironmental education contributes to the creative engagement of students in the search, discovery and inventing solutions to geoenvironmental problems. However, STEM contribution in shaping environmentally and socially sensitive citizens is not clear. That is why the need to shape environmentally and socially aware-sensitized citizens can be accomplished by HASS contribution [68], which helps understand the cultural, social and ethical framework [69]. In the Greek educational reality, the results from the implementation of an educational scenario of experimental multidisciplinary educational objects of STEM and HASS branches with the support of ICTs, demonstrate that the design and implementation of teaching approaches that combine in a multidisciplinary way the cognitive objects of the two branches are attainable. There are also indications of improving students' performance in identifying real complex problems caused by specific social behaviors and needs [70].

6. Conclusions

The purpose of this paper was to investigate the geocultural heritage understanding and the relative values of Junior High schools (Gymnasium) pupils and university students.

The participants of the research perceive in a high degree the aesthetic value and cultural value of geodiversity with its historical, archaeological and religious aspects, unlike geological value, which is perceived at a moderate degree. At a moderate grade, they also perceive the scientific value of geoheritage but recognize the need for geoeducation.

Unlike cultural, anthropocentric, utilitarian and economic values, the participants embrace in quite a low degree ecological, ecocentric and intrinsic values and do not support the three pillars of sustainability, which are economy, environment and society. Therefore, the contribution of geoethics in the recognition of intrinsic, social and economic value of geoheritage and geodiversity is highlighted.

The non-correlation of cultural value and geological value in perceptions between pupils and students essentially confirms the absence of deep geological knowledge in educational programs contrary to satisfactory knowledge development for culture, and the significant correlations between the perception of geological, geoethical and sustainable development values augment the perception of the need to provide more geological knowledge to develop geoethical and sustainable development values.

In this direction, environmental education with the integration of geoeducation (geo-environmental education) and the strengthening of geological heritage with holistic approaches and interdisciplinary links is called upon to play an important role in promoting its values, so we advocate that the need to shape environmental and socially sensitized citizens can be fulfilled with the contribution of HASS, which helps understand the cultural, social and moral framework. In this way, students will develop a sense of responsibility for their environment and a code of ethics for its protection and conservation. They will recognize geological heritage sites as protected areas and the need to manage them and also participate in environmental protection, particularly in the conservation of geoheritage.

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Appendix A

Questionnaire

001. Educational status

001.1 I am pupil of Junior High schools

002.2 I am student of the University of Thessaly

002. Gender

002.1 Male

002.2 Female

003. Programs participation

003.1 I have participated in a school Environmental Education Program

003.2 I have participated in a Cultural Program of the school

003.3 I have participated in extracurricular Program

003.4 I have not participated in an Environmental Education or Cultural Program

004. I am aware of Meteoras' existence

Yes:

No:

005. *I have visited Meteora*

Yes: No:

006. *I know about Meteora from the lesson of:*

- 006.1 History
- 006.2 Geology–Geography
- 006.3 Religious Education
- 006.4 Literature
- 006.5 Other lesson: _____

007. *The rocks of Meteora*

- 007.1 are volcanic rocks formed by the solidification of lava after a volcanic eruption
- 007.2 are rocks formed from material that has settled in water
- 007.3 come from meteorites
- 007.4 formed by rock landslides
- 007.5 resulted of the erosion of the coasts by the sea waters that existed in the area millions of years ago

008. *The rocks of Meteora were formed*

- 008.1 during thousands of years
- 008.2 during a few decades years
- 008.3 during millions of years
- 008.4 during hundreds of years
- 008.5 during a few days

009. *When do you think the rocks of Meteora will start to erode?*

- 009.1 They are already eroding
- 009.2 In tens of years
- 009.3 In hundreds of years
- 009.4 In thousands of years
- 009.5 In millions of years

010. *In your opinion, which Are the Most important aspects That (geo)education should develop? (Choose one or more)*

- 010.1 Geoscientific knowledge
- 010.2 Awareness about hazards
- 010.3 Responsible use of geo-resources
- 010.4 Capacity in sustainable approaches
- 010.5 Capability for risk mitigation
- 010.6 Value of environmental heritage and geoheritage
- 010.7 Importance of geosciences for daily life
- 010.8 None

Please indicate (✓) the extent to which you agree with the following suggestions:

(1: Strongly Disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly Agree)

1 2 3 4 5

011. *I would like to visit Meteora:*

- | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 011.1 to get to know the religious life of the monks | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 011.2 to enjoy the beauty of the landscape | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 011.3 to get to know the geological history of my place | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 011.4 to get to know the beauty of the monasteries | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 011.5 to admire the Byzantine treasures of the monasteries | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 011.6 I am not excited about a visit to Meteora | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Please indicate (✓) the extent to which you agree with the following suggestions: (1: Strongly Disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly Agree)	1	2	3	4	5
012. Meteora is extremely/highly interesting because:					
012.1 tourism is leading significant profits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
012.2 they are a legacy of the Orthodox Church	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
012.3 the monasteries are of architectural interest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
012.4 record the history of the planet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
012.5 endangered and endangered bird species are nesting (fauna)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
012.6 they are one of the most amazing landscapes in the world	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013. I believe that tourists visit Meteora because:					
013.1 it is a place of pilgrimage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013.2 it is a sacred place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013.3 sprout endangered plants (flora) that do not exist anywhere else on the planet (endemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013.4 there are fossils of a variety of species that lived millions of years ago	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013.5 it has geological interest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
013.6 the beauty of the landscape is unique	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014. The cultural value of Meteora lies in:					
014.1 their sacredness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014.2 the architecture of monasteries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014.3 the value of the Byzantine icons and murals of the monasteries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014.4 the rare manuscripts preserved in the monasteries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014.5 the orthodox religious tradition preserved by the monks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
014.6 information about the formation of Earth's relief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
015. The rocks of Meteora are evidence of the history of the earth (geo-history), which mainly concern the scientists of the Earth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
016. Meteora is a combination of natural and cultural heritage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
017. I think that in the case of Meteora the cultural heritage is superior to the geological heritage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
018. The value of the rocks of Meteora lies in the beauty of the landscape	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
019. The value of the rocks of Meteora is related to the sanctity of the place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
020. The value of the rocks of Meteora is connected with the architectural interest of the monasteries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
021. The value of the rocks of Meteora lies exclusively in the interest they present to geologists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
022. The protection of rocks is an issue that concerns only scientists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
023. The rocks of Meteora offer information about the history of earth science, which does not concern the majority of people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
024. The value of the rocks of Meteora is independent of the profit that tourism brings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
025. The value of the rocks of Meteora is independent of the aesthetic pleasure they offer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
026. If the rocks of Meteora had not been inhabited by the monks they would not have had any special value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
027. The rocks of Meteora have value on their own, regardless of economic criteria	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
028. The value of the rocks of Meteora lies in the economic benefits that tourism brings to the local community and the monks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate (✓) the extent to which you agree with the following suggestions: (1: Strongly Disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly Agree)	1	2	3	4	5
029. It is perfectly understandable that the monks and local businessmen of Meteora are interested in the development of tourism and the coverage of their financial needs and not in any impact on the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
030. The most important reason for protecting the rocks is the economic benefit for the locals and the monks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
031. The rocks of Meteora are important for the prosperity of the inhabitants of the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
032. The rocks of Meteora are important for the pleasure of the visitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
033. It is too much to talk about the protection and preservation of the rocks of Meteora	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
034. I am not interested in the debate on heritage protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
035. I am not particularly worried about heritage protection issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
036. The monasteries of Meteora must be protected because they are part of our cultural heritage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
037. The protection of Meteora is necessary in order to continue the monastic life of the monks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
038. The preservation of biological processes (fauna and flora) is independent of the preservation of geological processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
039. Abiotic components are not necessary for the biodiversity of the area because they cannot affect the conservation of plants and animals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
040. The (geo)tourism can arouse public interest the geology and the processes of landscaping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
041. It is perfectly understandable that the inhabitants of the Meteora area react negatively to the imposition of restrictions on the use of their land.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
042. It is natural that local businessmen and monks of Meteora do not agree with the restriction of the flow of tourists because their incomes will decrease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
043. The protection and conservation measures of Meteora must be observed by all interested parties (monastic community, municipal authority, visitors)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
044. It makes me sad that no measures are taken to regulate the flow of tourists in order to protect the spiritual character of the place and the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
045. I believe that the natural values of Meteora should impose strict restrictions on the activities of the locals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
046. In the management of Meteora there must be a reasonable balance between the benefits of tourism and environmental costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
047. There are teachers who encourage their students to collect fossils during educational visits to Meteora	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
048. It is positive that in Meteora there is "more tourism-more money" because Meteora is part of a renewable social and natural capital	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
049. The monks must be responsible for the construction of roads and their widening to facilitate visitors to the Monasteries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
050. The detachment of rocks due to the creation of car parks is a necessary intervention to serve the visitors of Meteora	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
051. The opening of roads and the creation of car parks are necessary human interventions and do not reduce the value of the place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate (✓) the extent to which you agree with the following suggestions: (1: Strongly Disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly Agree)	1	2	3	4	5
052. I do not understand why in the management of Meteora other bodies besides the monks should be involved (eg municipal authority)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
053. I fully understand that local entrepreneurs are interested in immediate economic benefits and not in a growth that will ultimately lead to greater profits in the long run	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
054. Meteora is a masterpiece of human intelligence and the idea for its construction is of special cultural value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
055. Meteora is a place of exceptional natural beauty and aesthetic value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
056. The ascetic lifestyle of the monks who lived there, is a typical example of harmonious coexistence of environmental landscape and human living	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Image: The five-story construction enclosed in the red circle was added for the needs of the monastic community.



057. Such additional constructions will help increase the number of tourists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
058. The addition of the new construction harmonizes with the monastery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
059. Additional constructions are necessary to serve the increased needs of the monks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
060. Such constructions contribute to the upgrade of the space	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B

Table A1. Summarized Data per Question of Questionnaire.

Question	Summarized Data		
01.0 Status of educational level	Pupils: 429(70.10%)	Students: 183(29.90%)	
02.0 Gender	Male: 255(41.67%)	Female: 357(58.33%)	
03.0 Programs participation			
03.1 I have participated in a school Environmental Education Program	Yes ($P_{\#}$): 123(28.67%)	Yes ($S_{\#}$): 84(45.90%)	Yes ($T_{\#}$)(%): 33.28
03.2 I have participated in a Cultural Program of the school	Yes ($P_{\#}$): 69(16.08%)	Yes ($S_{\#}$): 78(42.62%)	Yes ($T_{\#}$)(%): 23.63
03.3 I have participated in extracurricular program	Yes ($P_{\#}$): 66(15.38%)	Yes ($S_{\#}$): 63(34.43%)	Yes ($T_{\#}$)(%): 20.74
03.4 I have not participated in any Environmental or Cultural Program	Yes ($P_{\#}$): 210(48.95%)	Yes ($S_{\#}$): 15(08.20%)	Yes ($T_{\#}$)(%): 36.17

Table A1. Cont.

Question	Summarized Data	
04.0 I'm aware of Meteora's existence	Yes ₆₁₂ (N): 603(98.53%)	No ₆₁₂ (N): 9(1.47%)
05.0 I have visited Meteora	Yes ₆₁₂ (N): 456(74.51%)	No ₆₁₂ (N): 156(25.49%)
06.0 I know about Meteora from the lesson of:		
06.1 History	Yes ₆₁₂ (N): 69	Yes ₆₁₂ (%): 11.27
06.2 Geology–Geography	Yes ₆₁₂ (N): 318	Yes ₆₁₂ (%): 51.96
06.3 Religious Education	Yes ₆₁₂ (N): 339	Yes ₆₁₂ (%): 55.39
06.4 Literature	Yes ₆₁₂ (N): 24	Yes ₆₁₂ (%): 03.92
06.5 Other lesson: _____	Yes ₆₁₂ (N): 87	Yes ₆₁₂ (%): 14.22
07. The rocks of Meteora		
07.1 are volcanic rocks formed by the solidification of lava after a volcanic eruption	Yes ₆₁₂ (N): 126	Yes ₆₁₂ (%): 20.59
07.2 are rocks formed from material that has settled in water	Yes ₆₁₂ (N): 102	Yes ₆₁₂ (%): 16.67
07.3 come from meteorites	Yes ₆₁₂ (N): 30	Yes ₆₁₂ (%): 04.90
07.4 formed by rock landslides	Yes ₆₁₂ (N): 84	Yes ₆₁₂ (%): 13.73
07.5 resulted of the erosion of the	Yes ₆₁₂ (N): 270	Yes ₆₁₂ (%): 44.12
08. The rocks of Meteora were formed		
08.1 during thousands of years	Yes ₆₁₂ (N): 198	Yes ₆₁₂ (%): 32.35
08.2 during a few decades years	Yes ₆₁₂ (N): 27	Yes ₆₁₂ (%): 04.41
08.3 during millions of years	Yes ₆₁₂ (N): 249	Yes ₆₁₂ (%): 40.69
08.4 during hundreds of years	Yes ₆₁₂ (N): 102	Yes ₆₁₂ (%): 16.67
08.5 during a few days	Yes ₆₁₂ (N): 36	Yes ₆₁₂ (%): 05.88
09. When do you think the rocks of Meteora will start to erode?		
09.1 They are already eroding	Yes ₆₁₂ (N): 273	Yes ₆₁₂ (%): 44.61
09.2 In tens of years	Yes ₆₁₂ (N): 84	Yes ₆₁₂ (%): 13.73
09.3 In hundreds of years	Yes ₆₁₂ (N): 102	Yes ₆₁₂ (%): 16.67
09.4 In thousands of years	Yes ₆₁₂ (N): 84	Yes ₆₁₂ (%): 13.73
09.5 In millions of years	Yes ₆₁₂ (N): 69	Yes ₆₁₂ (%): 11.27
010. In your opinion, which are the most important aspects that (geo)education should develop? (Choose one or more)		
010.1 Geoscientific knowledge	Yes ₆₁₂ (N): 213	Yes ₆₁₂ (%): 34.80
010.2 Awareness about hazards	Yes ₆₁₂ (N): 336	Yes ₆₁₂ (%): 54.90
010.3 Responsible use of geo-resources	Yes ₆₁₂ (N): 375	Yes ₆₁₂ (%): 61.27
010.4 Capacity in sustainable approaches	Yes ₆₁₂ (N): 162	Yes ₆₁₂ (%): 26.47
010.5 Capability for risk mitigation	Yes ₆₁₂ (N): 234	Yes ₆₁₂ (%): 38.24
010.6 Value of environmental heritage and geoheritage	Yes ₆₁₂ (N): 408	Yes ₆₁₂ (%): 66.67
010.7 Importance of geosciences for daily life	Yes ₆₁₂ (N): 231	Yes ₆₁₂ (%): 37.75
011. I would like to visit Meteora:		
011.1 to get to know the religious life of the monks	M * (N ₆₁₂) = 3.7	
011.2 to enjoy the beauty of the landscape	M * (N ₆₁₂) = 3.7	
011.3 to get to know the geological history of my place	M * (N ₆₁₂) = 2.5	
011.4 to get to know the beauty of the monasteries	M * (N ₆₁₂) = 3.4	
011.5 to admire the Byzantine treasures of the monasteries	M * (N ₆₁₂) = 3.4	
011.6 I am not excited about a visit to Meteora	M * (N ₆₁₂) = 1.7	
012. Meteora is extremely/highly interesting because:		
012.1 tourism is leading significant profits	M * (N ₆₁₂) = 2.1	
012.2 they are a legacy of the Orthodox Church	M * (N ₆₁₂) = 3.9	
012.3 the monasteries are of architectural interest	M * (N ₆₁₂) = 3.5	
012.4 record the history of the planet	M * (N ₆₁₂) = 2.4	
012.5 endangered and endangered bird species are nesting (fauna)	M * (N ₆₁₂) = 2.4	
012.6 they are one of the most amazing landscapes in the world	M * (N ₆₁₂) = 3.4	
013. I believe that tourists visit Meteora because:		
013.1 it is a place of pilgrimage	M * (N ₆₁₂) = 2.5	
013.2 it is a sacred place	M * (N ₆₁₂) = 2.5	
013.3 sprout endangered plants (flora) that do not exist anywhere else on the planet (endemic)	M * (N ₆₁₂) = 2.4	
013.4 there are fossils of a variety of species that lived millions of years ago	M * (N ₆₁₂) = 2.4	
013.5 it has geological interest	M * (N ₆₁₂) = 2.4	
013.6 the beauty of the landscape is unique	M * (N ₆₁₂) = 3.6	

Table A1. Cont.

Question	Summarized Data
014. The cultural value of Meteora lies in:	
014.1 their sacredness	$M * (N_{612}) = 3.6$
014.2 the architecture of monasteries	$M * (N_{612}) = 3.5$
014.3 the value of the Byzantine icons and murals of the monasteries	$M * (N_{612}) = 3.3$
014.4 the rare manuscripts preserved in the monasteries	$M * (N_{612}) = 3.3$
014.5 the orthodox religious tradition preserved by the monks	$M * (N_{612}) = 3.7$
014.6 information about the formation of Earth's relief	$M * (N_{612}) = 2.4$
015. The rocks of Meteora are evidence of the history of the earth (geo-history), which mainly concern the scientists of the Earth	$M * (N_{612}) = 3.4$
016. Meteora is a combination of natural and cultural heritage	$M * (N_{612}) = 4.3$
017. I think that in the case of Meteora the cultural heritage is superior to the geological heritage	$M * (N_{612}) = 3.6$
018. The value of the rocks of Meteora lies in the beauty of the landscape	$M * (N_{612}) = 4.0$
019. The value of the rocks of Meteora is related to the sanctity of the place	$M * (N_{612}) = 3.5$
020. The value of the rocks of Meteora is connected with the architectural interest of the monasteries	$M * (N_{612}) = 3.8$
021. The value of the rocks of Meteora lies exclusively in the interest they present to geologists	$M * (N_{612}) = 3.4$
022. The protection of rocks is an issue that concerns only scientists	$M * (N_{612}) = 3.1$
023. The rocks of Meteora offer information about the history of earth science, which does not concern the majority of people	$M * (N_{612}) = 3.1$
024. The value of the rocks of Meteora is independent of the profit that tourism brings	$M * (N_{612}) = 2.8$
025. The value of the rocks of Meteora is independent of the aesthetic pleasure they offer	$M * (N_{612}) = 2.7$
026. If the rocks of Meteora had not been inhabited by the monks, they would not have had any special value	$M * (N_{612}) = 2.3$
027. The rocks of Meteora have value on their own, regardless of economic criteria	$M * (N_{612}) = 2.1$
028. The value of the rocks of Meteora lies in the economic benefits that tourism brings to the local community and the monks	$M * (N_{612}) = 3.5$
029. It is perfectly understandable that the monks and local businessmen of Meteora are interested in the development of tourism and the coverage of their financial needs and not in any impact on the environment	$M * (N_{612}) = 3.2$
030. The most important reason for protecting the rocks is the economic benefit for the locals and the monks	$M * (N_{612}) = 3.4$
031. The rocks of Meteora are important for the prosperity of the inhabitants of the area	$M * (N_{612}) = 4.4$
033. It is too much to talk about the protection and preservation of the rocks of Meteora	$M * (N_{612}) = 2.0$
034. I am not interested in the debate on heritage protection	$M * (N_{612}) = 1.9$
035. I am not particularly worried about heritage protection issues	$M * (N_{612}) = 2.0$
036. The monasteries of Meteora must be protected because they are part of our cultural heritage	$M * (N_{612}) = 3.6$

Table A1. Cont.

Question	Summarized Data
037. The protection of Meteora is necessary in order to continue the monastic life of the monks	$M^* (N_{612}) = 4.3$
038. The preservation of biological processes (fauna and flora) is independent of the preservation of geological processes	$M^* (N_{612}) = 3.3$
039. Abiotic components are not necessary for the biodiversity of the area because they cannot affect the conservation of plants and animals	$M^* (N_{612}) = 2.6$
040. The (geo)tourism can arouse public interest the geology and the processes of landscaping	$M^* (N_{612}) = 3.0$
041. It is perfectly understandable that the inhabitants of the Meteora area react negatively to the imposition of restrictions on the use of their land.	$M^* (N_{612}) = 3.4$
042. It is natural that local businessmen and monks of Meteora do not agree with the restriction of the flow of tourists because their incomes will decrease	$M^* (N_{612}) = 3.8$
043. The protection and conservation measures of Meteora must be observed by all interested parties (monastic community, municipal authority, visitors)	$M^* (N_{612}) = 4.3$
044. It makes me sad that no measures are taken to regulate the flow of tourists in order to protect the spiritual character of the place and the environment	$M^* (N_{612}) = 4.1$
045. I believe that the natural values of Meteora should impose strict restrictions on the activities of the locals	$M^* (N_{612}) = 3.3$
046. In the management of Meteora there must be a reasonable balance between the benefits of tourism and environmental costs	$M^* (N_{612}) = 4.0$
047. There are teachers who encourage their students to collect fossils during educational visits to Meteora	$M^* (N_{612}) = 3.1$
048. It is positive that in Meteora there is "more tourism, more money" because Meteora is part of a renewable social and natural capital	$M^* (N_{612}) = 3.5$
049. The monks must be responsible for the construction of roads and their widening to facilitate visitors to the Monasteries	$M^* (N_{612}) = 2.7$
050. The detachment of rocks due to the creation of car parks is a necessary intervention to serve the visitors of Meteora	$M^* (N_{612}) = 3.4$
051. The opening of roads and the creation of car parks are necessary human interventions and do not reduce the value of the place	$M^* (N_{612}) = 2.8$
052. I do not understand why in the management of Meteora other bodies besides the monks should be involved (eg., municipal authority)	$M^* (N_{612}) = 3.5$
053. I fully understand that local entrepreneurs are interested in immediate economic benefits and not in a growth that will ultimately lead to greater profits in the long run	$M^* (N_{612}) = 4.0$
054. Meteora is a masterpiece of human intelligence and the idea for its construction is of special cultural value	$M^* (N_{612}) = 3.9$
055. Meteora is a place of exceptional natural beauty and aesthetic value	$M^* (N_{612}) = 4.3$
056. The ascetic lifestyle of the monks who lived there are a typical example of harmonious coexistence of environmental landscape and human living	$M^* (N_{612}) = 4.2$
057. Such additional constructions will help increase the number of tourists	$M^* (N_{612}) = 3.7$

Table A1. Cont.

058. The addition of the new construction harmonizes with the monastery	$M * (N_{612}) = 3.9$
059. Additional constructions are necessary to serve the increased needs of the monks	$M * (N_{612}) = 3.9$
060. Such constructions contribute to the upgrade of the space	$M * (N_{612}) = 3.9$

$P_{\#}$: Pupils, $S_{\#}$: Students, $T_{\#}$: Total * Mean value in 1 to 5 Likert Scale.

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