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Survey of students' attitudes towards natural assets in relation to museum and field activities at the Kozárd geological section

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Tanulók attitűdvizsgálata a természeti értékekre vonatkozóan a kozárdi geológiai szelvény múzeumi és terepi foglalkozásaihoz kapcsolódóan

Összefoglalás

Tanulmányunk célja az általános iskolai tanulók attitűdvizsgálata a kozárdi geológiai szelvényhez kapcsolódó múzeumi és terepi foglalkozások kapcsán. A vizsgálatok során az egyik tanulói csoport múzeumi és terepi foglalkozáson is részt vett, egy másik csoport csak terepen járt, míg egy hasonló létszámú kontrollcsoport egyik programon sem vett részt. A kutatásban vizsgálni kívántuk a tanulók élő és élettelen természeti értékek iránti hozzáállását, attitűdjét gondolati térkép és Likert-skála segítségével. Az eredmények azt mutatják, hogy a legnagyobb attitűdváltozás akkor következett be, amikor a terepi foglalkozást múzeumi program is kiegészítette.

Tárgyszavak: szarmata kor, ősmaradvány, Kozárd, környezeti nevelés, múzeumpedagógia, terepi foglalkozás

Abstract

The aim of our study is to investigate the attitudes of elementary school students as a result of museum and field activities at the Kozárd geological section. During the study, one group of students participated in both museum and field sessions, another group only visited the field site, and the control group of a similar number of students did not participate in either of the two programs. In this study, we investigated the students' approach and attitude towards living and non-living natural assets with the help of mind maps and the application of the Likert scale. The results show that the biggest change in attitude occurred when the field work was supplemented by a museum program.

Keywords: Sarmatian age, fossil record, Kozárd, environmental education, museum pedagogy, fieldwork

Introduction

Research goals, hypotheses, location of the survey

Elekes (2012) investigated whether functional knowledge that leads to the protection of nature can be developed in children through planned education in museum pedagogy. Her research confirmed that through conscious education, children can develop the mental structure necessary to deal with environmental problems. In the framework of our doctoral research, we examined the role of museums in the development of environmentally conscious behavior. A portion of the surveys were conducted at the Pásztó Museum as a permanent location. The purpose of this survey was to measure the attitude towards natural assets among elementary school students (students in fourth- and sixth-grade classes) in connection with a museum or a field activity. In this study, we examined the students' attitudes towards living and non-living natural assets, as well as the changes in attitudes resulting from these sessions. According to our hypothesis, the attitude of the students participating in both the museum and the field activities will change in a more positive direction, compared to those only encountering our non-living assets during the field practice. According to our second hypothesis, the children participating in the sessions have a more positive environmental attitude than the students who did not participate in these activities.

The location of the student field sessions was the Kozárd geological section, and the museum sessions took place at the permanent exhibition of the Pásztó Museum entitled "The Message of Millions of Years in Nógrád". The Miocene paleontological documentation of the Nógrád region is well represented in this collection of the Pásztó Museum, which isa thematic natural science museum.

Geological background – the Kozárd section

In Nógrád county, north of the village of Kozárd, an outcrop on the east side of the road connecting the settlement with the Nagymezőpuszta reveals formations of Sarmatian age with a thickness of 3–4 m along a length of 300 m (*Figures 1, 2*).

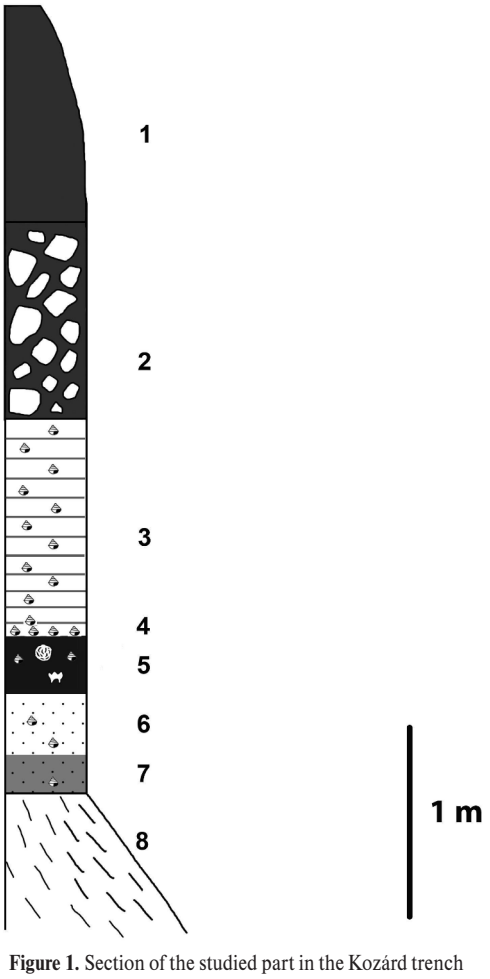

Figure 1. Section of the studied part in the Kozárd trench
1: recent soil, 2: debris, 3: greenish-grey sandy marl containing mollusc shells, 4: yellow sand containing abundant mollusc shells (lumachelle), 5: dark gray organic rich diatomaceous silt containing mollusc shells, *Celtis* seeds and vertebrate fragments, 6: grey sand containing mollusc shells, 7: reddish sand containing mollusc shells, 8: colluvium

1. ábra. *A kozárdi árok vizsgált szakaszának szelvénye*
1: jelenkori talaj, 2: lejtőüledék, 3: zöldesszürke, homokos márga, mely puhatestűhéjakat tartalmaz, 4: sárga homok, mely különösen gazdag puhatestűhéjakban (lumasella), 5: sötétszürke, szerves anyagban gazdag, diatomás silt, mely puhatestűhéjakat, Celtis*-magvakat és gerincesmaradványokat tartalmaz, 6: szürke homok puhatestűhéjakkal, 7: vörös homok puhatestűhéjakkal, 8: lejtőtörmelék*

The layers of sandy marl, organic rich diatomaceous siltstone and sandstones contain an extraordinary abundance of mollusc shells. The mass of mollusc shells forms lumachella in some of the strata.

NOSZKY (1912) was the first to study the geology of the Kozárd area. The first description of the mollusc remains of the localities in the village is attributed to BOKOR (1941); however, he only provided faunal lists. BODA (1959, 1971, 1972) provided a detailed description, as well as stratigraphical and paleoecological interpretation of the fossil assemblage.

Based on the biostratigraphic position of the mollusc fauna, BODA (1974) divided the section into the lower "Kozárd" and upper "Tinnye" substages of the Sarmatian. The Kozárd trench was designated as the stratotype section of the upper Sarmatian "Kozárd substage". This stratigraphical subdivision is not widespread in the international literature. Later, lithostratigraphic units were introduced using the same names (HÁMOR 1985): the Kozárd Formation name is used for rocks formed in offshore environments, and the Tinnye Formation name is used for the sediments deposited in nearshore environments. HÁMOR (1985) designated the studied locality as the type section of the Kozárd Formation. The section was cleaned and excavated, and the Kozárd Ko–1 borehole was deepened at the southern end. The problem of the lithostratigraphic definition of the Kozárd section was recently discussed by SELMECZY & FODOR (2023).

The foraminifera fauna was first studied by HÁMOR (1985). Later, the lower section of the strata was re-examined by HÍR et al. (2016). She drew the following conclusions from the microfauna: based on the foraminifera *Elphidium reginum*, and the index fossils *Aurila mehesi* and *Cytheridea*, the age of the studied sediments is the lower Sarmatian *Elphidium reginum* zone *(Figure 3)*.

A brackish shallow marine depositional environment was reconstructed for the Kozárd section by BODA (1974). Based on current analogues (HARTMANN 1975, LACHENAL 1989), the ostracod community indicates a well-ventilated shallow marine environment between the wave base and the storm base, where the water depth was less than 80 m. The substrate was covered with rich algal vegetation (HÍR et al. 2016). In 2014, vertebrate remains were found in a 15-cm-thick organic rich diatomaceous silt level of the section.

In addition to the typical Sarmatian fossils related to restricted marine environment, the intensely sampled organic rich level contains shells of freshwater, and terrestrial gastropods, and a mass of *Celtis* seeds. The rodent finds can be classified in the MN 7+8 zone of the Neogene terrestrial biochronology. According to STEININGER (1999), the MN 7+8 zone is can be correlated with the uppermost part of the Badenian Stage and the Sarmatian Stage in the Central Paratethys. The herpetofauna indicates a dry, bushy environment (*Pelobates* sp., *Bufotes* cf. *viridis*, *Pseudopus* sp., Lacertidae indet., Colubridae indet.). Among the rodents, there are elements of the forest. Squirrels: *Spermophilinus bredai*, flying squirrels: *Albanensia albanensis*, glirids: *Muscardinus* cf. *sansaniensis*, *Myoglis meini*, also. However, most of the finds were provided by a hamster *"Cricetodon"* cf. *klarian-*

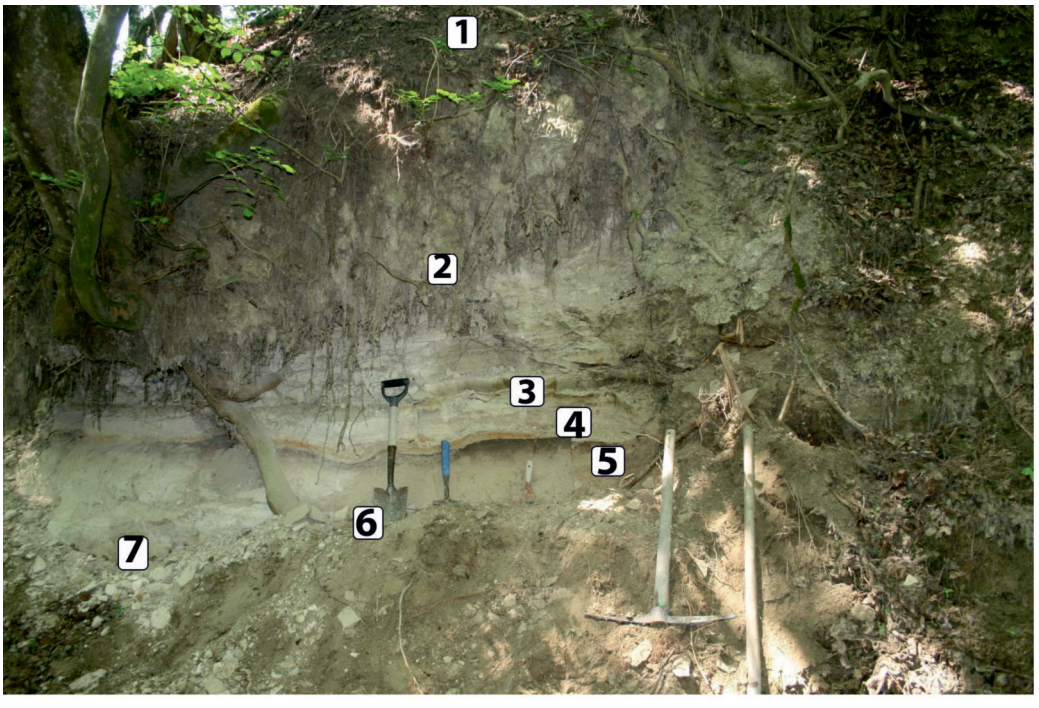

Figure 2. Photo of the studied section. Numbering is identical to *Fig. 1*
2. ábra. *A vizsgált szelvény fotója. A rétegszámozás azonos az* 1. ábrával

kae, which has a semihypsodont dental crown. The *Cricetodon* genus is assumed to also have preferred a dry, warm climate (De Bruijn & Ünay 1996, Daxner-Höck 2003). Other rodent species point to a humid environment: *Megacricetodon minor-minutus* gr., *Democricetodon* sp., *Anomalomys gudryi.*

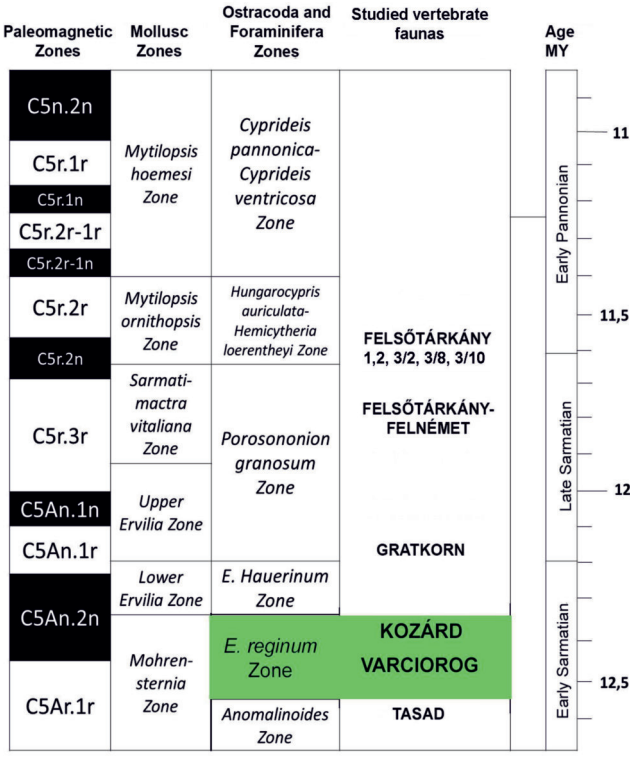

Figure 3. The chronologic position of the Kozárd vertebrate fauna related to other studied vertebrate localities in the Pannonian Basin
3. ábra. *A kozárdi gerinces fauna kronológiai helyzete a Pannon-medence többi gerinceslelőhelyéhez viszonyítva*

Shaping of Attitude: environmental and museum pedagogical background

Attitude is a social-psychological concept describing orientation and setup of thinking (Molnár 2009). During interactions, attitudes determine the personality in intellectual, emotional, and behavioural areas (Major 2012). According to the three-dimensional attitude model, attitude is the three-dimensional construct of the evaluation of the object (affective), opinion related to the object (cognitive), and behavioural intentions or behaviour (conative) (Kohler 2001). Developing the right attitude towards the environment is one of the main goals of education; it has an impact on the behaviour system of the personality (Lükő 2003, Major 2012). According to the knowledge–attitude–behaviour model, environmental knowledge results in a positive environmental attitude, and a positive environmental attitude results in environmentally conscious behaviour (Major 2012). However, the structure of environmental consciousness is much more complex than can be explained by a three-dimensional attitude model (Kohler 2001). In the process of environmental education, the transfer of basic knowledge is a condition, but our goal is to shape setups, attitudes, and emotional approaches (Lehoczky 1998). The interpretation of the components of the attitude, the possibilities of its development and formation, and the methods of measuring it are extremely complicated and can be approached from sev-

eral directions. Due to this complexity, a detailed description of every approach is beyond the scope of this study, and here we only provide a brief summary to aid our interpretations. If we develop the appropriate environmentally aware attitude of students as soon as possible, they can become adults who protect the values of nature (KÓNYA 2019). Students' beliefs, emotions, and experiences play a decisive role in terms of their attitudes towards natural sciences (DOBA & SZÁNTÓNÉ 2019).

A museum can be an important factor in environmental education (FODOR 2015), since one of the basic missions of a museum is to create a connection between science, heritage, and society (BOUDJEMA 2019). Museum institutions offer a variety of environmental media (FORTIN-DEBART 1999). In addition to exhibitions, museums can also make their programs more engaging with interactive tools and activities, and both of which can help shape a museum visitor's view of nature and the environment (DOMINEK 2021). The environmental education opportunities inherent in natural history museums carry a particularly high potential. Natural history museums keep specimens of protected, endangered or even extinct plants and animals in their scientific collections, that is, they can present priceless assets that would not be possible to get to know and experience up-close anywhere else (VÁSÁRHELYI 1993). The relationship between museums and environmental education is not new. The idea of nature conservation has permeated the research and museum pedagogic activities of natural history museums and museum departments for decades (VÁSÁRHELYI 2012). According to LORD (2007), museum learning is a transformative, affective experience in an informal, voluntary environment in which we develop new attitudes, interests, understandings, beliefs, or values. A museum, therefore, can positively influence not only the lives of local residents, but also those of its visitors, as it can contribute to changing their attitude towards any matter.

The greatest advantage of fieldwork is the long-term proximity to nature (KERÉNYI 1996). A field session facilitates a systematic approach to the environment and the acquisition of complex, activity-based knowledge (KÁRÁSZ 2003). In the development of positive emotional attachment to nature, programs that provide an experience of freedom and discovery are relevant (CSONKA & VARGA 2019). Fieldwork is more informal, versatile, diverse and spectacular than museum work; therefore, it requires more attention and mindful behaviour.

Measurement of attitudes

In the last few decades, many international and national research have been undertaken to measure environmental attitudes, selecting different target groups. Conventional scales were used for the surveys, primarily the CHEAKS scale (LEEMING et al. 1995, GULYÁS & VARGA 2009) and various versions of the so-called NEP scale (New Environmental Paradigm Scale, Modified New Ecological Paradigm Scale) (CSONKA 2019). Non-standardized procedures have also been used by various researchers.

VARGA (2006) showed negative trends in the development of environmental attitudes over time in the case of primary and secondary school students. KÓNYA (2018, 2019) investigated the environmental attitudes of secondary school students attending eco-schools and non-eco-schools. According to his findings, the environmental attitude of high school students is not significantly influenced by the eco-character of the school, and in the case of ninth-grade students, he measured higher attitude values than in higher grades. Only the amount of environmental knowledge has increased over the years. KÖVECSESNÉ (2015) assessed the attitude change of children participating in a forest school program. At the end of the one-week forest school program, a change in the attitude of the students was detectable, but this change was no longer detectable after half a year. When examining the attitudes of university students regarding environmental awareness and sustainability, KÖVECSESNÉ (2020) found that an environmentally conscious approach was important to the respondents. A similar survey was conducted with the participation of secondary school students, student teachers, teachers, young parents and grandparents at the Benedek Elek Faculty of Education of the University of Sopron (KOLLARICS et al. 2020, 2021), where attitudes were considered positive for all target groups. In connection with the week-long themed sustainability program, several authors investigated the environmental attitudes of primary and secondary school students via a large-scale survey. Based on their results, the responding students had a socio-cultural background higher than the national average, and most students declared themselves more environmentally aware than the average; however, most of them are only moderately interested in environmental news (MÓNUS et al. 2022, BERZE et al. 2022). Among the studies related to environmental awareness and sustainability, we also found studies that aimed to assess knowledge about climate change, attitudes towards it, and the willingness to act in an environmentally conscious way considering different target groups (JANKÓ et al. 2018; KOLLARICS, 2021, 2023; WUMAIER et al. 2022). We also found an example of investigating the attitude towards renewable energies (REVÁKNÉ et al. 2019). Among field environmental education activities, PAP (2021) investigated the impact of nomadic camps on the environmental attitudes of primary school students during a small sample study, where half of the responding children felt that they had become much more nature-loving and much respectful towards living beings than before the camp. Among international surveys, JAHNKE (2011) investigated the effects of out-of-school, mobile (carried out by minibus) environmental activities on the participants' attitudes in Germany, involving elementary school students. KOHLER (2001) assessed the effects of forest pedagogy sessions of museums among primary school students, focusing on the changes in the knowledge and attitudes of the participants. SLOTOSCH (2001) investigated changes in knowledge, attitude, and behaviour during forest school programs also in Germany.

Materials and methods

In May 2023, we delivered a lecture to fourth- and a sixth-grade classes about the middle Miocene Sarmatian period at the Pásztó Museum's permanent exhibition *"The message of millions of years in Nógrád" (Figure 4)*, then we visited the Kozárd geological section with the students, where, during a field session, they had a chance to observe what they had heard the previous day about the fauna hidden within Sarmatian limestones.

Figure 4. Activities at the Pásztó Museum
4. ábra. *Foglalkozás a Pásztói Múzeumban*

We took students of a fourth grade and a sixth grade class to the type area of the Kozárd section *(Figure 5)*. These students did not previously participate in a guided tour of the museum.

When choosing the sampling site, we aimed to ensure that its location was fit for the purpose, while the risk of accident was as low as possible. Prior to field work, the students received a description of the area and the assignment, namely that they will be looking for buried and preserved remains of organisms from earlier geological periods, i.e. fossils. Following the presentation of the tools, the rules of field safety and appropriate behaviour, the children searched for fossils by imitating an excavation. When fossils were found, we demonstrated the correct way of extraction. Following this demonstration, the students were eventually able to carry out the excavation independently. The students also received information regarding the appropriate equipment and clothing during field work. During the fieldwork, students and instructors respected the written and unwritten rules of behaviour in nature, that is, the students avoided being noisy, and the participants disturbed the study site only to the most necessary extent.

Figure 5. Students working in the type area of the Kozárd geological section
5. ábra. *Munka a kozárdi geológiai szelvény típusterületén*

A total of 92 students participated in the field and museum sessions. Then, in the second half of the study using Likert scale, two classes with 46 students were assigned to a control group. The attitude change was investigated using two methods. As one of the methods, we created and analysed conceptual maps. This method has already been used in national and international research (e.g. Kövecsesné 2015, Slotosch 2001) and in longitudinal surveys. The essence of the conceptual map (mind map) is that the students receive a concept, which they supplement with concepts, thoughts, and feelings on a graphic sketch based on their own logic. If they see a connection between some of the written information, they connect them. Both before and after the sessions, we asked the students of the four classes to list all the possible terms they could think of regarding the topic of non-living natural assets. Seventy-three mind maps were returned to us for analysis (n total = 73). We were curious to what extent the amount of knowledge of concepts and natural science tools, and the structure of the conceptual maps changed on an individual level comparing the two studies (before and after the sessions). As part of our study, we measured what the most common concepts were on the mind maps, as well as to what extent changes occurred as a result of the sessions. We also considered the extent to which the structure of the conceptual maps and the number of concepts changed comparing the two studies. During the analysis, we summarized the concepts that appeared on the maps and their frequency. During each study, we looked at the frequency of occurrence of all appearing concepts. We grouped these around broader topics for the easier analysis. We set up 16 categories in which we sorted every single concept. The categories consisted of groups such as zoology, botany, general geography, geology, but also the presence of man in nature, negative appearance, etc. Here, the children listed things like littering, tearing off flowers, killing animals, etc. When connecting concepts, we gave as many points as were logically connected on the map.

We also investigated the attitude change using another method, where we used a self-reported Likert scale in surveys to collect sufficient information regarding positive or negative attitudes of the participants (Zerényi 2016). This objective scale shows quantifiable results regarding attitudes. Half a year after the sessions (by when the students were in the 5th and 7th grade), we assessed the students' attitude towards their environment through longitudinal research.

This self-report measure was also completed by a similar number of students as control group in order to compare the results (n total = 138 persons). The control group consisted of 5th and 7th grade students who were neither at the museum presentation nor at the geological survey session.

To compile the Likert scale, we used the official international attitude scales (NEP, CHEAKS) (LEEMING et al. 1995, GULYÁS & VARGA 2009, CSONKA 2019) based on previous national and international research using these standard scales (primarily JAHNKE 2011, KÖVECSESNÉ 2015, JANKÓ et al. 2018, MÓNUS et al. 2022, BERZE et al. 2022; see previous chapter). However, due to the special nature of the study, some of the standard statements were adapted to the field/museum topic. The students who participated in the study were presented 22 statements that related to their habits, behaviour, intentions, emotions and thinking regarding the environment. The students marked their agreement or disagreement on a Likert scale ranging from 1 to 5 (1: completely disagree; 5: completely agree with the statement). For the sake of reliability, we also formulated reverse statements in order to filter out automatically circled responses.

Results and discussion

Mind maps

It was very noticeable on the mind maps that the students acquired a significant amount of knowledge as a result of the sessions *(Figures 6–9)*.

Participants in the field-only program named a large number of living creatures seen in nature (spider, ant, cockroach, flower, mushroom, tree, bush, etc.) and treasures found in the excavation (shell, mussel, fossil, bone, etc.) after the session. They also formed an opinion about the session ("I really liked it", "it was brilliant", "I felt great", "it was amazing", "my hand hurt afterwards", etc.).

However, those students who had participated in the museum session before the field work presented their thoughts in a much more accurate and precise form after the session. Several geographical names also appeared on their association maps. In the category of Tools, mostly the tools with which they had worked during the field work were listed

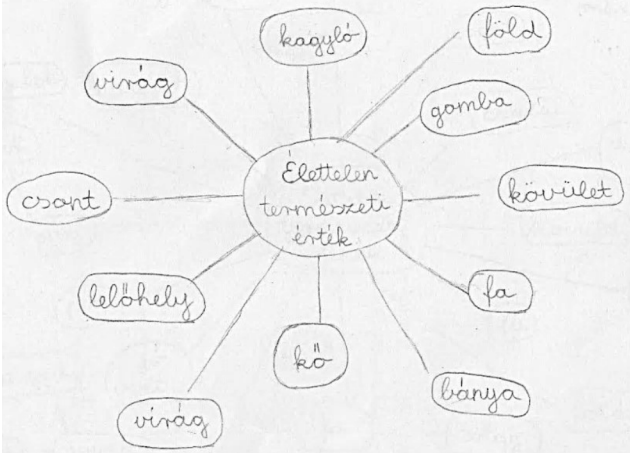

Figure 6. Mind map of a student participating only in the field session – before the session

6. ábra. *Csak terepi foglalkozáson részt vevő diák gondolati térképe a foglalkozás előtt*

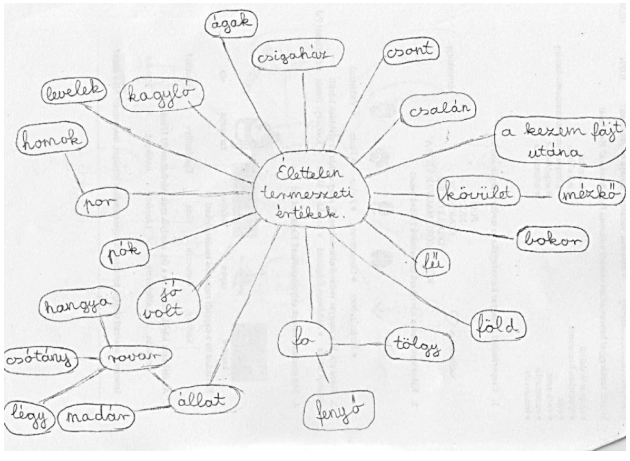

Figure 7. Mind map of a student participating only in the field session – after the session

7. ábra. *Csak terepi foglalkozáson részt vevő diák gondolati térképe a foglalkozás után*

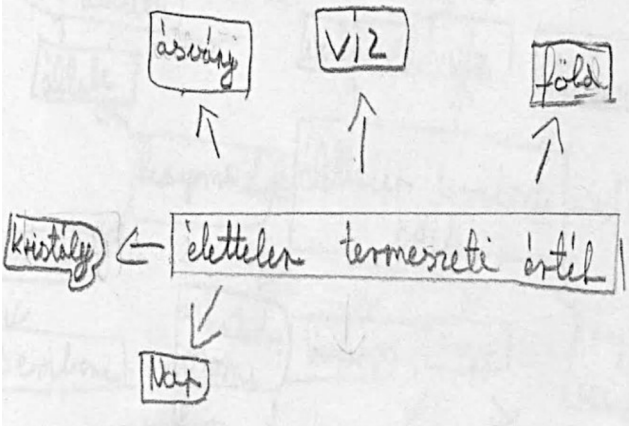

Figure 8. Mind map of a student participating both in the field and the museum sessions – before the session

8. ábra. *Terepi és múzeumi foglalkozáson részt vevő diák gondolati térképe a foglalkozás előtt*

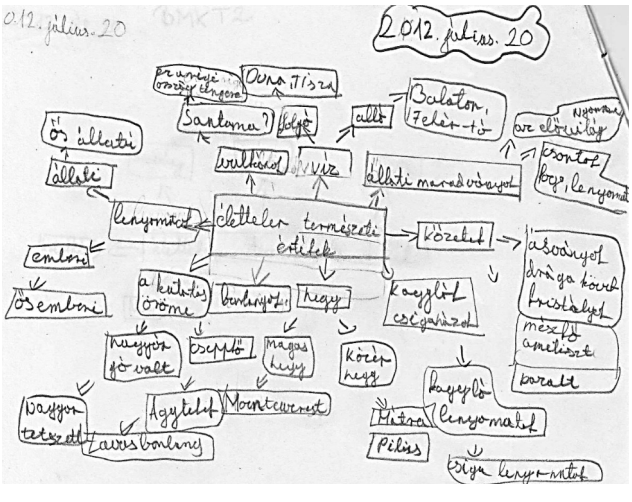

Figure 9. Mind map of a student participating both in the field and the museum sessions – after the session

9. ábra. *Terepi és múzeumi foglalkozáson részt vevő diák gondolati térképe a foglalkozás után*

(spade, chisel, hammer, axe, etc.). Emotional expressions occurred, too, regarding nature ("the place was breathtaking", "the weather was gorgeous", "I adore the chirping of birds", etc.), and also, the program itself was praised by the children ("it would be nice if there were more of this", "I just loved everything", "I quite fancy these activities", etc.). There were negative emotions, as well. Some students made empathic conclusions ("everyone dies someday", "we were looking for dead animals", "we are destroying our world", etc.), and not everyone was completely satisfied with the session itself, either ("I was stung by a nettle", "my leg hurt", "after a while it was boring", etc.) The categories and the number of concepts are summarized in *Tables I and II*.

After examining the extent and direction of changes in Study II compared to Study I, we found that the amount of words related to botany and zoology increased to an almost equal extent in the group only participating in the field session compared to the other one participating both in the museum and the field activity. For students interested only in the field program, more concepts appeared in Study II in categories such as Natural phenomena; Connecting concepts; Negative emotions (empathic conclusions, related to the activity), Disclosure of material assets and personal interests, compared to the case of their peers participating also in museum sessions. In categories Geography, general geography, and natural geography; Geology, petrology, mineralogy; Geology, paleontology; Tools; Positive emotions (related to nature, related to work), the number of conceptual quantities increased to a greater extent for the students participating both in the museum and the field sessions. Contrary to expectations, a significant, smaller decrease was observed in Study II in the category of Human presence in nature, negative appearance in the case of both groups.

There were also significant changes in the structure of conceptual maps. As the number of concepts grew, so did their levels, deeper and deeper conceptual maps were made, and more and more associations were discovered on the different levels among the students who had taken part both in the museum and in the field sessions. It is also clear from the individual studies that the conceptual maps expanded with many elements, including the material of the presentation given in the museum.

During this study, we investigated the extent to which the children's new knowledge had increased. We grouped the increase in knowledge by 10% increments *(Table III)*. *Table III* shows the distribution of children belonging to each growth group.

Table I. Quantification of the concepts and structuredness depicted in the mind maps of the students only participating in the field session – before the session (Study I) and after the session (Study II)

I. táblázat. *A csak a terepi foglalkozáson részt vevő diákok által gondolati térképeken ábrázolt fogalmak és strukturáltság számszerűsítése a foglalkozás előtt (I. vizsgálat) és után (II. vizsgálat)*

	Number of concepts (students having been only in the field n=39)	
Categories	**Study I**	**Study II**
Biology, botany	15	48
Biology, zoology	9	62
Geography, general geography, and natural geography	87	86
Geology, petrology, mineralogy	45	27
Geology, paleontology	77	132
Natural phenomena	8	29
Human presence in nature, in a historical sense	8	2
Human presence in nature, negative appearance	10	3
Connecting concepts	1	184
Tools	7	25
Positive emotions: related to nature	10	40
Positive emotions: related to occupation	16	55
Negative emotions: empathic conclusions	1	10
Negative emotions: related to occupation	1	5
Disclosure of material assets and personal interests	1	8
It's an incomprehensible thought for me	1	1

The members of the two different groups achieved an increase of 10% to almost the same extent. In the case of the 39 students participating only in the field, they achieved a higher percentage of quantitative growth in the category showing an increase of 30%, 40%, 70% and 80%. In the category showing a quantitative increase of 50%, 60% and

Table II. Quantification of the concepts and structuredness depicted on the mind maps of the students participating both in the field and the museum sessions – before the sessions (Study I) and after the sessions (Study II)

II. táblázat. *A terepi és a múzeumi foglalkozáson részt vevő diákok által gondolati térképeken ábrázolt fogalmak és strukturáltság számszerűsítése a foglalkozás előtt (I. vizsgálat) és után (II. vizsgálat)*

	Number of concepts (students having been both in the museum and in the field n=34)	
Categories	**Study I**	**Study II**
Biology, botany	12	27
Biology, zoology	2	14
Geography, general geography, and natural geography	123	305
Geology, petrology, mineralogy	42	131
Geology, paleontology	17	233
Natural phenomena	33	38
Human presence in nature, in a historical sense	6	18
Human presence in nature, negative appearance	1	0
Connecting concepts	11	315
Tools	1	5
Positive emotions: related to nature	1	22
Positive emotions: related to occupation	1	35
Negative emotions: empathic conclusions	1	1
Negative emotions: related to occupation	1	1
Disclosure of material assets and personal interests	1	1
It's an incomprehensible thought for me	1	0

Table III. Comparison of the quantification of concepts and structuredness depicted on individual mind maps between students participating only in the field session and those participating both in the field and the museum sessions

III. táblázat. *Egyéni szintű gondolati térképeken ábrázolt fogalmak és strukturáltság számszerűsítésének összehasonlítása a csak terepi foglalkozáson részt vevő diákok, valamint a terepi és a múzeumi foglalkozáson is részt vevő diákok között*

Percentage growth at the individual level according to the mind maps after the session	Distribution of the knowledge of the 39 students participating in the field	Distribution of the knowledge of the 34 students participating both in the museum and the field
10%	2.56%	2.94%
20%	0.00%	0.00%
30%	20.51%	5.88%
40%	10.26%	2.94%
50%	12.82%	23.53%
60%	12.82%	41.17%
70%	20.51%	11.76%
80%	20.51%	8.82%
90%	0.00%	2.94%
100%	0.00%	0.00%

90%, the group visiting both the museum and the field was in higher proportion. In this study, we did not create mind maps with the control group.

Results of attitude change

Another method of detecting the change of attitude was the questionnaire survey, where the students could give their answers on a 5-point Likert scale: 1 = Completely disagree; 2 = Mostly disagree; 3 = Neither agree nor disagree; 4 = Mostly agree; 5 = Completely agree.

The data were evaluated using the statistical-mathematical program IBM SPSS 26.0. The answers given by the students were analysed in three groups according to the hypotheses: 1= they were only in the field; 2= they were both in the museum and in the field; 3= control group.

The first statement was: "I worry about people not taking care of their environment."

The children who were only in the field and those who were in the control group were thinking almost the same, but the group who was also in the museum showed a statistically demonstrably higher level of worry *(Figure 10)*.

Figure 10. "I worry about people not taking care of their environment." (Horizontal axis: 1: they were only in the field, 2: they were also in the museum, 3: control group. Vertical axis is the degree of worry)

10. ábra. *„Aggódom amiatt, hogy az emberek nem vigyáznak a környezetükre." Vízszintes tengely: 1: csak terepen voltak, 2: múzeumban is voltak, 3: kontrollcsoport. Függőleges tengely: az aggódás mértéke)*

A relevant statement for the survey was: "I would like to take part in sessions with the theme of preserving living and non-living natural assets." For this statement, the groups that participated in the field sessions only (1) and those having been both in the museum and the field sessions (2) gave similar answers, compared to the control group (3) whose members showed less interest *(Table IV)*.

The following statement aimed to measure environmental awareness based on self-report ("I consider myself environmentally conscious"). This statement is usually part of the international scales and is therefore important to highlight. Contrary to expectations, the results of Group 1 and Group 3 were exactly the same (average of 4.07), while the members of the group who were both in the museum and in the field (Group 2) answered with a higher average of 4.43. This confirms our first hypothesis, according to which the attitude of the students participating in both the museum and the field activities will change in a more positive direction, compared to those only encountering our non-living assets during the field practice.

Table IV. "I would like to take part in sessions with the theme of preserving living and non-living natural values." Averages of the answers to the sixth statement

IV. táblázat. *„Szívesen vennék részt olyan foglalkozásokon, amelynek témája az élő és élettelen természeti értékek megőrzése." A hatodik állítás válaszainak átlagai*

Group 1 (they were only in the field)	Group 2 (they were both in the museum and in the field)	Group 3 (control)
4.26	4.15	3.74

According to our second hypothesis, the children participating in the sessions have a more positive environmental attitude than the students not participating in them. For statement 10, according to which "I don't usually get nervous because of environmental problems", the results of the students participating in the museum session, too (2), reflect the most positive attitude *(Figure 11)*.

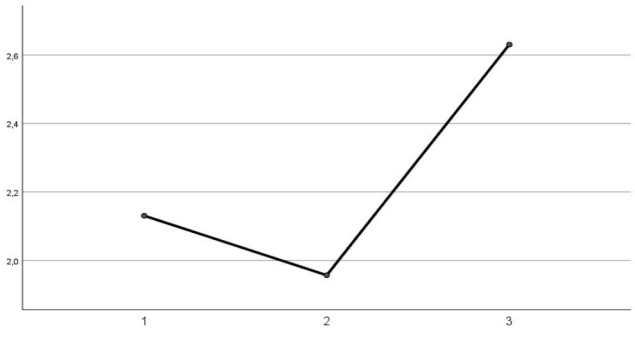

Figure 11. "I don't usually get nervous because of environmental problems." (Horizontal axis: 1: they were only in the field, 2: they were also in the museum, 3: control group. Vertical axis is the level of worry)

11. ábra. *„A környezeti problémák miatt nem szoktam idegeskedni." (Vízszintes tengely: 1: csak terepen voltak, 2: múzeumban is voltak, 3: kontroll csoport. Függőleges tengely: az aggódás mértéke)*

The following statement was important to examine in terms of the relationship with nature: "I'd rather go to the mall than to nature." Again, the answers of the members of Group 2 (having been both in the museum and in the field) were the most positive with an average of 2.3, the average of Group 1 (having been only in the field) was 2.8, while that of the Control group was 2.72.

Next statement was a negative statement: "I feel no remorse for man-made environmental problems." *Table V* shows the results:

Table V. "I feel no remorse for man-made environmental problems." Averages of the responses to the thirteenth statement (N=46 for each group)

V. táblázat. *„Nem érzek lelkifurdalást az ember okozta környezeti problémák miatt." A tizenharmadik állításra adott válaszok átlagai (N=46 minden egyes csoport esetén)*

Group 1 (they were only in the field)	Group 2 (they were both in the museum and in the field)	Group 3 (control)
2.35	1.76	2.15

We observed that the responses of Group 2 (who were both in the museum and in the field), again, reflect the most positive attitude for this statement.

The statement "Sometimes I try to convince others that environmental protection/nature conservation is important" focused on action as opposed to attitude (so it goes beyond the analysis of attitudes towards action): In the case of Group 2 (who were both in the museum and in the field), the results support and confirm the study of attitudes *(Figure 12)*.

In the context of museum and field activities, it was important to test the following statement: "I have already participated in a program that influenced my environmental awareness." The result is shown in the graph *(Figure 13)*. As expected, it is the control group who agreed the least with the statement that they had already participated in a program that influenced their environmental awareness.

The average of answers given to the next relevant statement ("It saddens me that so much construction deprives animals/plants of their natural habitat.") was the highest among students who were both in the museum and the field sessions (4.63). The average of the answers of Group 1 (they were only in the field) was 3.93, the average of the answers of the control group was 4.11.

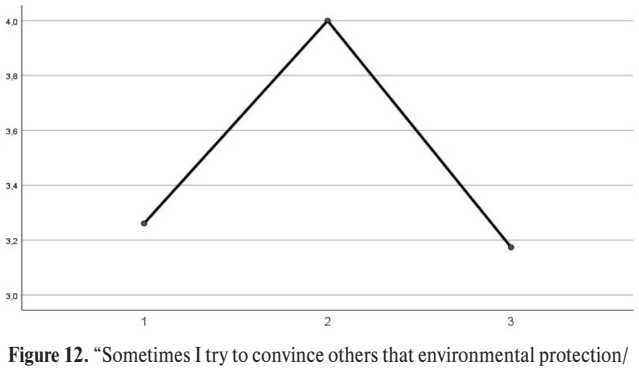

Figure 12. "Sometimes I try to convince others that environmental protection/nature conservation is important." (Horizontal axis: 1: they were only in the field, 2: they were also in the museum, 3: control group. Vertical axis is the degree of intension of persuasion)

12. ábra. *„Próbálok néha másokat meggyőzni, hogy a környezetvédelem/természetvédelem fontos dolog." (Vízszintes tengely: 1: csak terepen voltak, 2: múzeumban is voltak, 3: kontroll csoport. Függőleges tengely: a meggyőzésre való törekvés mértéke)*

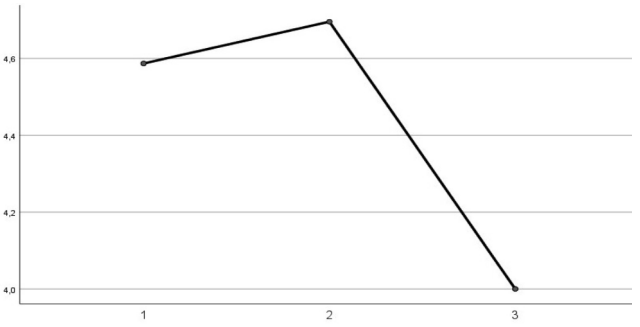

Figure 13. "I have already participated in a program that influenced my environmental awareness." (Horizontal axis: 1: they were only in the field, 2: they were also in the museum, 3: control group. Vertical axis is the degree of participation in the program)

13. ábra. *„Részt vettem már olyan programon, ami befolyásolta környezettudatosságomat." (Vízszintes tengely: 1: csak terepen voltak, 2: múzeumban is voltak, 3: kontroll csoport. Függőleges tengely: a programon való részvétel mértéke)*

The last relevant question again goes beyond attitudes and aimed to examine action ("I would warn the person who collects rare assets protected in nature (e.g. plants)."). Based on the results *(Table VI),* the responses of Group 2 (they were both in the museum and the field) reflect the highest intention to act.

Table VI. "I would warn the person who collects rare assets protected in nature (e.g., plants)." (N=46 for each group)

VI. táblázat. *„Rászólnék arra az emberre, aki a természetben védett, ritka értéket gyűjt (pl. növényt)." (N=46 minden egyes csoport esetén)*

Group 1 (they were only in the field)	Group 2 (they were both in the museum and in the field)	Group 3 (control)
3.98	4.57	4.07

Based on the results of the statistical tests, the first hypothesis, according to which the attitude changes in a more positive direction for the children participating in both the museum and the field sessions, compared to those only encountering our non-living assets during the field exercise, was confirmed. This is supported quantifiably by the positive changes in the expansion and structure of the conceptual maps.

According to our second hypothesis, the children participating in the sessions have a more positive environmental attitude than the students not participating in them. Based on the analysis of the mathematical statistics of the answers to the Likert scale questions, this assumption did not hold up.

Conclusions

The results of both the completed conceptual maps and the Likert scale reflect that environmental education activities are necessary. The quantitative and qualitative growth of the concepts clearly show the effectiveness of the sessions. For students interested only in the field program, more concepts appeared during the second test in relation to natural

phenomena and their own emotions, while the majority of the students participating both in the museum and in the field sessions had thoughts referring to natural science knowledge. According to our assumptions, the attention of those who were both in the museum and in the field was divided between what they heard at the lecture and what they experienced in the field. Meanwhile, the children who did not participate in the museum activities were more able to focus on the natural phenomena in the field. Examining attitudes is more difficult, but our study provided statistically detectable and quantifiable results whereby the change is almost always positive, but not always significant. However, for the students participating both in the museum and the field sessions, the effect of the sessions in the positive, long-term change of attitudes was verified statistically. We consider it a significant result that based on our tests, the museum programs strengthen the effectiveness of the field activities aimed at environmental education. Based on our results, we are convinced that the presence of environmental education, field activities and, last but not least, museums is significant in students' lives. Museums can play a huge role in environmental education. Museums help students through providing an environment where the students can logically and immediately observe the desired processes, tools, objects, and, in addition to imparting new knowledge, museums also help to organize the knowledge the students already acquired. Furthermore, field activities are essential in the acquisition of natural science knowledge. In addition to knowledge, students also gain experiences, thus influencing the development of a positive attitude. Based on our research, we conclude that museum pedagogy sessions aimed at environmental education effectively help the practical implementation of sustainability pedagogy, which is why it should play a role in public education.

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