EXAMINING ENVIRONMENTAL AWARENESS OF UNIVERSITY STUDENTS

Andras Szeberenyi, Rita Lukacs, Arpad Papp-Vary
Budapest Metropolitan University, Hungary
aszeberenyi@metropolitan.hu, rlukacs@metropolitan.hu , apappvary@metropolitan.hu

Abstract. Environmental awareness has become perhaps one of the most widely used terms today. But how do young people relate to it? Our research hypotheses examined the opinions and attitudes of students at the Budapest Metropolitan University when they were first introduced to the concept of environmental awareness, when they first learned about it, how important they consider environmental protection to be in today's world, and to what extent environmental problems affect people's health. In our research, we formulated three hypotheses, tested by a questionnaire as a primary research method. The research results were analysed using Pearson's chi-squared test and variance analysis as statistical methods to determine whether there is a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories. The results show that the majority of students (85.19%) had heard about environmental awareness before starting secondary school and that 83.61% of them had learned about the importance of renewable energy, environmental awareness or environmental protection in Biology and/or Geography classes. We also analysed the correct or incorrect handling of certain types of waste (e.g., plastic, takeaway paper cups, used tissues and napkins, yoghurt and sour cream cups, styrofoam, broken mirrors etc.). The research highlighted the types of waste for which some significant differences were found. For example, there was a significant difference in the treatment of plastic cup tops, which means that those who have learned about renewable energy, environmental awareness, or environmental protection in Biology and/or Geography classes are more likely to treat cup tops correctly as waste.

Keywords: environmental protection, student attitudes, waste management, environmentally conscious lifestyle.

Introduction

The concept of environmental awareness is becoming more and more apparent to people of different generations. It is no longer just in the news or in textbooks, but also everyday places such as grocery stores, petrol stations, shopping centres, tobacco shops and car showrooms. As a result, there are fewer and fewer people who have not yet heard about this issue in some form, whether it is climate change, importance of the ecological footprint, deteriorating conditions of air and water, increased use of renewable energy or the environmental problems of overpopulation. This also shows that this is a truly complex and wide-ranging area that affects every single person on the Earth, without exception. In our comprehensive study, the following hypotheses are emphasised in relation to the examined topic:

- *Hypothesis 1: A significant proportion of students, at least half, were already familiar with the concept of environmental awareness or had heard about it before starting secondary school.*
- *Hypothesis 2: Students who first learnt about renewable energy, environmental awareness and environmental protection in biology and geography are more aware of the importance of disposing of waste in the right place, compared to their classmates who learnt about these topics in other subjects.*
- *Hypothesis 3: More than half of students think that environmental problems such as water and air pollution have a significant impact on people's health, and that it is essential to change people's consumption habits to reduce them.*

In 2000-2010, there was relatively little academic writing on the comprehensive study of environmental lifestyles and the attitudes of different age groups and generations. At the international level, the approaches [1; 2] should be mentioned as a guideline for environmental aspects. In the 1990s, they already devoted much attention to the effects of global environmental problems and possible solutions to them. In the Hungarian context, it was the works [3-5] that dealt with a greater extent with the main trends in environmental protection, environmental management and eco-efficiency in Hungary. After 2011, an increasing number of researchers and disciplines began to address what is perhaps one of the most important issues for the future of humanity – the role of long-term responsible thinking about our environment.

Fast-forward to the present, and with the climate situation continuing to deteriorate, a new problem of global proportions has suddenly emerged - the Covid-19 disease, which in the space of a few months has triggered a lockdown affecting the entire population of the planet for the first time in history [6]. The pandemic has profoundly disrupted normal daily life, but it has also created a rapid wave of

uncertainty – for example, about mortality rates, short and long-term symptoms, levels of infection and how much longer we will have to endure this emergency. Another negative consequence of the pandemic is that the future prospects of the younger generation have become uncertain [5; 7]. This does not only refer to the global financial and economic crisis, or newer problems – such as the increase in environmental pollution caused by cryptocurrency mining [8], but also to the fact that decisions taken to mitigate the pandemic – such as mandatory mask wearing, rubber gloves, PCR and coronavirus antibody tests, etc. – are demanding the use of additional single-use devices, mainly made of plastic and rubber, which contribute even more intensively to the increase in environmental burden and individual ecological footprint. At a time when the European Union is highlighting a number of sustainability pillars [9] and the importance of a circular economy [10], for example, on plastic cutlery, cups, plates and straws, could have reduced the production and use of persistent and highly harmful plastic waste, we must also face the new waste generated by the billions of masks, rubber gloves and plastic-covered tests that are produced every week and discarded after a single use.

However, there is an unexpected positive side to the pandemic. The aforementioned global shutdown has shown that, if drastic action is taken, climate change can be reversed more effectively than previously thought. A report published by the Hungarian Academy of Sciences on 18 May 2020 also confirms this, saying: *"The temporary shutdown has improved air quality but has not solved the problem of climate change. Worldwide, air pollution has fallen measurably over large cities and regions, and noise and light pollution have also fallen dramatically. However, greenhouse gas concentrations are expected to have fallen very little at best till 2020 as the researchers expected, because long-term emissions of these gases are the key factor"*.

It is important to mention this, as the World Health Organization (WHO) has shown that poor air quality is a factor in the premature deaths of millions of people every year [11]. However, due to sudden quarantine measures, air pollution has been significantly reduced in many countries such as Bangladesh, India, Indonesia, China and Pakistan, where it has been the leading problem for decades, but where effective action has rarely been taken.

Among the many examples mentioned above, and for the purposes of our study, we are most concerned about air pollution in Hungary, with a particular focus on university students studying in Budapest, who are also increasingly concerned about the symptoms of air pollution, which have a significant negative impact on their health.

Joshua Stevens, in a paper published in National Geographic – Earth, reports several measurements that clearly show a significant reduction in nitrogen dioxide (NO_2) and particulate matter ($PM_{2,5}$) concentrations, especially in industrial regions and large cities [12].

Table 1 shows the change in the air quality between 2018 and 2021 for the countries we have already mentioned as examples, where air pollution is much more severe than in other countries. The last element in the table is the change in particulate matter concentrations for Hungary. The IQAir 2021 database distinguishes seven different categories based on particulate matter concentrations of 2.5 microns. To understand Table 1, the categories can be interpreted as follows:

1. Hazardous $> 50.1 \ \mu g \cdot m^{-3}$;
2. Very unhealthy $35.1\text{-}50 \ \mu g \cdot m^{-3}$;
3. Unhealthy $25.1\text{-}35 \ \mu g \cdot m^{-3}$;
4. Unhealthy for sensitive groups $15.1\text{-}25 \ \mu g \cdot m^{-3}$;
5. Moderate $10.1\text{-}15 \ \mu g \cdot m^{-3}$;
6. Good $5.1\text{-}10 \ \mu g \cdot m^{-3}$;
7. WHO guideline $0\text{-}5 \ \mu g \cdot m^{-3}$;

Based on the [13] live city ranking we do not wish to show all the major cities' results but only the first five and the Hungary's case. Looking at the data of April 2022, Bhiwadi's (India) air quality and pollution rate is the worst (106.2 $\mu g \cdot m^{-3}$), followed by Ghaziabad (India, 102 $\mu g \cdot m^{-3}$), Hotan (China, 101.5 $\mu g \cdot m^{-3}$), Delhi (India, 96.4 $\mu g \cdot m^{-3}$) and Jaunpur (India, 95.3 $\mu g \cdot m^{-3}$). Budapest's (Hungary) value is 14.2 $\mu g \cdot m^{-3}$, which falls into the 'moderate' category.

Although the results in Table 1 show that Hungary's overall air quality is better than most of the other countries mentioned as examples, it still falls at the lower end of the 'moderate' category in the case of polluted countries. It is worth noting that in 2020 China was placed at the upper end of the same 'moderate' category based on its air pollution levels at that time, but this does not mean that Hungary is

one of the most polluted countries, it is simply compared to the average of the larger countries. Another interesting result is the situation in Ukraine and Italy, where pollution is steadily increasing but still falls into the 'moderate' category. In contrast, all other countries show an improving trend for the period 2018-2020, even if they do not fall into the same particulate matter concentration category.

Table 1

Changes in particulate matter concentrations of 2.5 microns between 2018 and 2021 for the most polluted countries (µg·m⁻³)

Country	2018 average	2019 average	2020 average	2021 average	Population
Bangladesh	97.1	83.3	77.1	76.9	164.7 million
Pakistan	74.3	65.8	59.0	66.8	220.9 million
India	72.5	58.1	51.9	58.1	1380.1 million
Mongolia	58.5	62.0	46.6	33.1	3.3 million
Indonesia	42.0	51.7	40.7	34.2	273.5 million
China	41.2	39.1	34.7	32.6	1439.3 million
Ukraine	14.0	16.6	19.2	18.5	43.7 million
Italy	14.9	17.1	18.5	15.2	60.5 million
…					
Hungary	16.8	14.6	14.3	15.5	9.6 million

Note: The table does not include values for all countries
Source: Own edited table based on IQAir – World's most polluted countries database, 2022

Although Covid-19 has for a while distracted people from the rapidly growing problems associated with climate change, overall the symptoms affecting our environment have not disappeared, but rather have been transformed or reclassified. In the light of the above, air pollution, for example, has improved globally in almost all countries, in return for a dramatic increase in waste production. This one factor alone shows that nations have had to learn in a relatively short period of time that there is no time to worry about one thing at a time, but rather the need to address multiple complex issues simultaneously, while maintaining the priority ranking that remains the overriding importance of climate change [14].

However, for this multi-level problem-solving to be effective, it is necessary to involve certain groups, or rather generations of people if we want to achieve effective improvements. One of the biggest areas in which these groups or generations can play their part is in learning, practising and passing on environmentally responsible lifestyles [15]. This type of environmental education can be effective if it can not only have a significant impact on everyday lifestyles and consumer behaviour, but also have an equal or greater impact on the environmental awareness of those involved [16].

There is no doubt, therefore, that the younger generation, including university students, can make a major contribution to the development of an even broader perspective on environmental awareness.

Materials and methods

Now that we have a better understanding of why we need to put more emphasis on environmentally conscious lifestyles, we would like to present our extensive research among students at the Budapest Metropolitan University. Prior to the research, we formulated a number of hypotheses, based on which we asked students a total of 58 questions in the primary research questionnaire. A total of 307 students completed the online questionnaire between April and June 2021, with a gender distribution of 120 men and 187 women.

In our study, we used statistical methods to study the results in more detail. For these, we only present those that provide relevant results for statistical correlation analysis. We consider the correlation coefficient to be significant at a level less than 0.05, and briefly discuss the indicators of the strength of the relationships that can be identified, which in the case of our results are as follows:

- $|r| = 0$ – in this case there is no detectable relationship;
- $0 < |r| < 0.1$ – there is a negligibly weak relationship between the two variables;
- $0.1 \leq |r| < 0.3$ – indicates a weak relationship;
- $0.3 \leq |r| < 0.5$ – indicates a moderate relationship;
- $0.5 \leq |r| < 1$ – indicates a strong relationship.

Results and discussion

As this is a detailed study, we will only present part of the results in this paper. In the following, we will highlight the three hypotheses related to our study, already mentioned above, and the results related to them.

Hypothesis 1. A significant proportion of students, at least half, were already familiar with the concept of environmental awareness or had heard about it before starting secondary school.

To obtain results relevant to the first hypothesis, it was first necessary to ask when the students first heard about environmental lifestyles. Seven different possible answers were formulated for this question, to which a total of 307 respondents replied. In terms of the method used to test the hypothesis, we were interested in the percentage of respondents who had first heard about environmental awareness before or after starting secondary school. Thus, the following groups had to be created: 1) First heard of it before starting secondary school, 2) First heard of it after starting secondary school, 3) Did not want to answer the question.

For the results presented in Figure 1, the 64 respondents who marked the third response option, – i.e. did not wish to answer the question – were not included in the plot as they are not relevant results for the hypothesis testing.
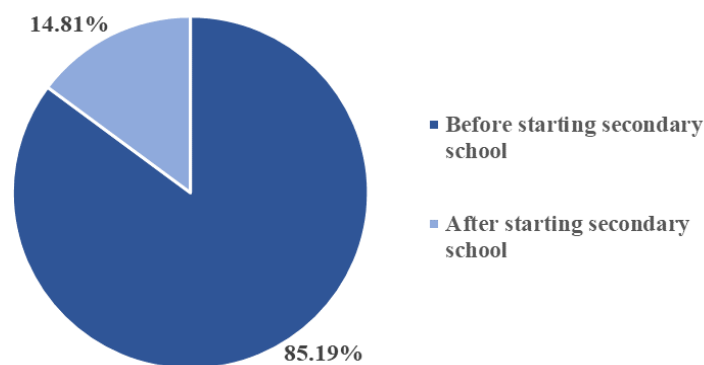
Source: Own edited figure based on primary research, 2021, n = 243

Fig. 1. **Distribution of students according to when they first heard about environmental lifestyles (%)**

The results in Figure 1 show that the majority of the students surveyed (85.19%) had heard about environmental awareness before starting secondary school. As similar surveys on this topic have been carried out in previous years (e.g., 2015-2020), this average can be considered very good when compared to the results of previous surveys. Only a small proportion of students, around 14.81%, belong to the group who first heard about environmental awareness after starting secondary school.

Based on the results, we therefore accept our first hypothesis that a significant proportion of students, at least half of them, were already familiar with the concept of environmental awareness or had heard about it before they started secondary school.

Hypothesis 2. Students who first learnt about renewable energy, environmental awareness and environmental protection in biology and geography are more aware of the importance of disposing of waste in the right place, compared to their classmates who learnt about these topics in other subjects.

For the second hypothesis, it was necessary to ask which subjects, if any, had been taught about the role and importance of environmental awareness. The relevant question was which subjects had taught students about renewable energy, environmental awareness or environmental protection. All possible subjects were listed here, and the respondents could choose more than one. The results for this question are shown in Figure 2, which received a total of 307 responses.

According to the results illustrated in Figure 2, 83.61% of the students who participated in the survey learned about the importance of renewable energy, environmental awareness or environmental protection in Biology and/or Geography classes, which is also a high percentage. A total of 16.39% of respondents indicated one or more other subjects in which they had learned about environmental awareness or indicated that they had not learned about these topics in any class.
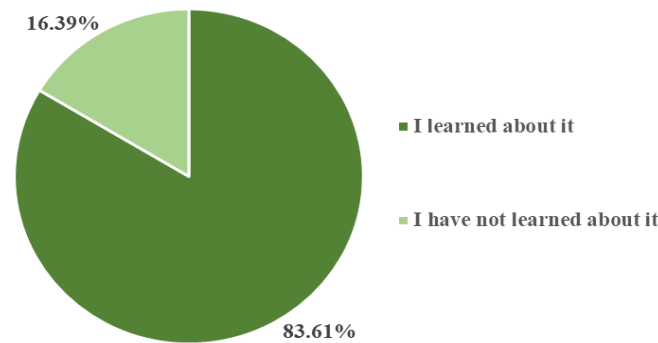
Source: Own edited figure based on primary research, 2021, n = 307

Fig. 2. **Distribution of students according to whether they have studied environmental awareness or environmental protection in Biology and/or Geography classes (%)**

However, this question alone is not enough to answer our hypothesis, as it does not show whether students who fall into the category "I have learned about it in Biology and/or Geography classes" are more aware of where to dispose of different types of waste compared to their counterparts in the "I have not learned about it" category. Therefore, we have included several questions in our questionnaire that focus on the relationship with waste management. We have covered a range of products, tools and materials – such as plastic cup lids; paper takeaway cups; used tissues and napkins; paper food containers; yoghurt and sour cream cans and the foil on top of them; styrofoam; broken mirrors destined for discard – but in this research we only present the results for the listed waste types in terms of whether these waste types are generally disposed of in the right place.

Table 2 presents the results of our statistical correlation analysis based on Pearson's Chi-square test. The first column shows the types of waste we surveyed, for which respondents were given six options to choose where they dispose of them: mixed waste, paper waste, plastic waste, organic waste, landfill, or if they do not know how they should dispose of that particular waste. The second column shows the appropriate place of disposal for the types of waste examined, which is relevant for the mismanagement and correct management indicators.

In the correlation analysis, the "Educated" and "Uneducated" groups shown in Figure 2 were compared with the "Incorrect handling" and "Correct handling" methods. The results in the third column show the percentage of respondents in the "Uneducated" category who generally dispose of the waste in the wrong place, and the results in the fourth column indicate the percentage of respondents in the "Educated" category who dispose of the waste in the right place. The results in the fifth column show the percentage of respondents in the "Uneducated" category who could not decide how they usually handle these products, tools and materials. For the sixth column, we also examined the same category, but for those who fell into the "Educated" category.

In this research, we emphasise the types of waste for which some significant differences were found. For example, for handling of plastic cup lids, there is a significant difference based on the Pearson $\chi2$ test (4.346 $p = 0.037$ (2-tailed) $\varphi = 0.122$), as the φ value for effect-size shows a weak effect. Based on these results, it is clear that those who have learned about renewable energy, environmental awareness or environmental protection within the framework of Biology and/or Geography subjects are more likely to correctly handle the cup lids as waste.

A significant difference was also observed in the case of the used tissue (Pearson $\chi2 = 6.774$ $p = 0.009$ (2-tailed) $\varphi = -0.151$), with a weak inverse effect. In practice, this means that students in the "Uneducated" category are more likely to correctly handle this type of waste. One likely reason for this is that they pay less attention to selective waste collection and tend to use the mixed waste bin, which is the correct form of disposal for used tissues. A weak inverse effect, and thus a significant difference, was also observed for the handling of the used napkins (Pearson $\chi2 = 4.337$ $p = 0.037$ (2-tailed) $\varphi = -0.121$) and yoghurt and sour cream cans (Pearson $\chi2 = 5.561$ $p = 0.018$ (2-tailed) $\varphi = -0.137$). Therefore, here again, students in the "Uneducated" category are in the majority, who manage these types of waste more correctly when using the mixed waste bins. For the other waste types, our statistical

analysis showed no significant relationship or association between the indicators and the groups. Consequently, based on the data presented above, our second hypothesis was refuted by the results of the correlation tests, as students in the "Uneducated" category tended to throw the waste types listed in the survey more often in the right place, compared to their peers in the "Educated" group.

Table 2

Results of Pearson's chi squared statistical correlation test and distribution of the students surveyed according to whether they correctly or incorrectly handle the types of waste identified

Type of waste	Appropriate storage space	Incorrect handling/Uneducated	Correct handling/Educated	Do not know/Uneducated	Do not know/Educated
plastic cup lids	plastic waste	36%	72.9%	4%	5.1%
paper takeaway cups	paper waste/landfill	38%	62.7%	8%	5.9%
used tissues	mixed waste	34%	42.9%	2%	2.4%
used napkins	mixed waste	40%	42.7%	2%	2.4%
paper food containers	paper waste/landfill	44%	60.8%	0%	3.5%
yoghurt and sour cream cans	mixed waste	68%	16.9%	0%	3.1%
foil of yoghurt and sour cream cans	landfill	92%	0.4%	8%	7.1%
styrofoam	landfill	68%	20.4%	18%	18.8%
discarded/ broken mirrors	landfill	48%	33.7%	12%	24.7%

Source: Own edited figure based on primary research, 2021

Hypothesis 3. More than half of students think that environmental problems such as water and air pollution have a significant impact on people's health, and that it is essential to change people's consumption habits to reduce them.

Our third hypothesis is closely related to the problem of water and air pollution, which was also addressed at the beginning of our study. To investigate this, we looked at 13 related questions – two of which are, for example, how the university students in Budapest who took part in our research think that environmental damage could be reduced and how important they think environmental protection is in today's world. In the former case, they were asked to select only one of our predefined answers, while in the latter they were asked to express their own opinion on a scale of 1 to 5, where a value of 1 meant that they did not consider environmental protection important at all; a value of 5 meant that they considered it very important.

Our first highly significant result, with a moderately strong relationship, concerned the importance of being environmentally friendly when making purchases ($r = 0.351$). This result made it clear that this aspect is indeed very important to them when they buy a product. The second and third significant but weakly correlated results relate to the preference for buying food from domestic ($r = 0.200$) and organic farming ($r = 0.179$) respectively. In this context, therefore, students prefer to buy products that are either domestic food or from organic farming. But the most interesting result is that when we statistically test the issues most relevant to our hypothesis, such as global warming ($r = 0.263$), the situation of factories emitting toxic air ($r = 0.265$), the worsening rate of water and air pollution ($r = 0.238$), the importance of environmental education ($r = 0.351$), and the protection of the planet's environment ($r = 0.285$), all

show a significant relationship between the variables compared, at least weak, and a moderate relationship for the importance of environmental education.

The results obtained from the correlation results, therefore, indicate that students are theoretically very interested in the importance of environmental protection and the promotion of environmentally conscious lifestyles, as they are concerned about the adverse health effects of water and air pollution. They are keen to play their part in promoting an environmentally responsible lifestyle through the examples mentioned above. Overall, these results justify accepting our third hypothesis.

Conclusions

In our complex primary research, we also examined a number of topics focusing on environmental awareness, sustainability and environmental protection. Although only a small part of this has been presented in this study, it is already clear that the topic is of vital importance, even in the current pandemic context.

Using our three hypotheses, we analysed the students' knowledge of environmental awareness as a concept; we conducted statistical analyses to determine whether there is a significant or relevant relationship between the subjects in which students have learned about environmental awareness and environmental protection and whether this is related to their knowledge of the appropriate disposal locations for the types of waste we identified; and how students think about environmental problems, such as water and air pollution, and whether they think these have a significant impact on people's health.

As a conclusion, it is worth highlighting that the majority of the students surveyed (85.19%) had heard about the environmental awareness before starting secondary school, and 83.61% of them learned the importance of renewable energy, environmental awareness and protection in Biology and/or Geography classes. The results related to the second and third hypotheses show that although the students in the study try to do their part in the main characteristics of an environmentally conscious lifestyle, and they consider it to be a significant value, their knowledge of certain topics of environmental awareness, such as waste management, is insufficient. These findings are confirmed by our statistical results, which show, for example, that 92% of the students throw the foils of yoghurt and/or sour cream cans in the wrong waste. Therefore, we can say that students are committed to environmental awareness theoretically, but in terms of practical methods – based on concrete results – this commitment is not fully reflected.

These are important areas where renewable energy, sustainability and environmental awareness will play a key role not only now but also in the future. In our next research, we plan to develop studies to this extent, which will help us get a more clear picture of which methods could be most effective in promoting solutions and knowledge to further increase environmental awareness.

Author contributions:

Conceptualization, A.Sz., R.L. and Á.P-V.; methodology, A.Sz., Á.P-V.; formal analysis, A.Sz.; investigation, Á.P-V.; writing-original draft preparation, A.Sz.; writing-review and editing, R.L. and Á.P-V.; visualization, A.Sz.; project administration, A.Sz. and Á.P-V.; grammar verification, A.Sz., R.L. and Á.P-V. All authors have read and agreed to the published version of the manuscript.

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