

KNOWLEDGE OF THE NATURAL ENVIRONMENT AND ITS PRESERVATION, AND THE ORIGINS OF SUCH KNOWLEDGE AMONG POLISH ADOLESCENTS

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Purpose: The aim of this article is to present the results of a study concerning the knowledge and understanding exhibited by Polish secondary and technical education students regarding the natural environment, the causes and effects of pollution, strategies of its preservation and protection, and the sources from which young people gather information about these issues.

Design/methodology/approach: The study was conducted in 2022-2023 on a group of 710 students from secondary schools and technological education schools in various Polish cities. The study was conducted using a questionnaire formulated by the author, encompassing questions designed to assess the knowledge, as well as the sources of knowledge, of the participants.

Findings: Participants exhibited the highest levels of knowledge concerning strategies for protection of the natural environment. They also showed good levels of knowledge about recently publicized issues, such as e.g., the effects of global warming. The issues which the participants turned out to be least informed on were very recent issues, or which are rarely discussed. Social media turned out to be the most important source of knowledge about environmental protection for Polish youth. School was only ranked in third place as a source of knowledge about environmental protection, scoring lower than after Internet sources such as social media and information portals.

Practical implications: Information regarding the level of knowledge and the sources from which young people gain knowledge are great importance for decision-makers in the fields of both formal and informal environmental education of young people. On the one hand, the low place occupied by schools as a source of knowledge for young people may be an indication that more emphasis should be placed on formal education on environmental issues. On the other hand, however, the great influence of online sources should not be underestimated. It would be worthwhile to take a closer look at the content of online knowledge and to enrich the offered non-formal education available on social media.

Originality/value: The presented study is one of the few studies on the knowledge about the state of the natural environment and the processes taking place within it. This knowledge is an important element of environmental awareness, in addition to practical knowledge and beliefs.

Keywords: adolescent, environmental awareness, environmental protection, environmental pollution, social media.

Category of the paper: Research paper.

1. Introduction

Knowledge about the natural environment is an important element of ecological awareness, i.e. the awareness of the existence of a specific area of phenomena associated with ecology, i.e. the science dealing with the relationship between humans and the natural environment. Environmental awareness consists of knowledge, views, and ideas about the environment (Hull, 1984). The shaping of environmental awareness is connected to the awareness of the disturbance of these relations caused by human activity and the need to undertake efforts for the preservation of the environment. Environmental awareness emerges when the issue of the relationship between man and the environment as a condition for the future development of civilization gains importance within our shared social consciousness. This means thinking about the natural environment as an element of the human world that should be protected (Picht, 1981; Meadows et al., 1973; Jonas, 1996). The social influence of ecological awareness grew rapidly in the 1960s and 1970s. In the decades following that, however, a certain degree of stagnation took hold, due to criticism from groups which consider ecological diagnoses to be too radical and catastrophic.

The situation changed in 2018 when new IPCC special reports showed the reality of the threat of a climate catastrophe in the coming decades of our century (Special Report, 2018). The increasingly real prospect of a global climate catastrophe in the coming decades makes the field within which environmental awareness can be shaped, a key issue for the future, thus determining its continued presence in social awareness. There are many publications devoted to this issue, for example, A. Kuzior has been dealing with this problem for many years (2010; 2013, 2014, 2016).

In Poland, in recent years, an increase in the interest in environmental issues related to environmental protection can be observed. A smog alert was announced in Poland in 2017. The IPCC special report on global warming and climate change published in 2018, drew the attention of Polish public opinion on these issues, which are most intensively addressed in the media. The awareness of environmental threats was accompanied by discussions about the need to take specific actions. There was a definite departure from plastic, as well as a change in the thinking and practice of waste segregation (Act of 14 December 2012 on waste). There were also subsequent pro-environmental advertising and campaigns, both social and commercial, with the participation of various celebrities.

Our knowledge and beliefs about the natural environment should influence our behavior towards it. Transmitting knowledge in this area and shaping positive attitudes, i.e. environmental education for younger children and ecological education for older students, is the duty of the Polish schools derived from the Core Curriculum in force, since the Regulation of the Ministry of National Education of May 21, 2001 on the core curriculum for pre-school education, general education in particular types of schools, and education in certain profiles in

profiled high schools, through successive regulations published on this matter in the following years.

There is a long tradition of research on the level of ecological knowledge of different generations. Many studies have focused on university students because they constitute the most dynamic group. The knowledge, opinions and interests of students determine the future of a given community to the greatest extent. Students also played an important role in the development of the environmental movement (Reich, 1976). They were the center of youth contestation in the US and Western Europe in the 1960s. Thanks to them, the issues of ecological threats were publicized. For decades, animators of ecological organizations have been recruited from among the students of Western universities. For this reason, research on the attitudes of students has played and still plays, an important role in identifying the moods and directions of thinking of future elites and opinion-forming circles.

Studies of the attitudes among university students conducted in 2016 showed a relatively similar level of knowledge among students from different faculties and from universities (Ciążela, 2018, Ciążela, 2021c). Reflection on the results concerned the reasons for such a state of affairs. Perhaps young people acquire specific knowledge about the natural environment and its protection already in high school? Maybe the main sources of knowledge of young people are different than formal education? High school youth, therefore, are another group whose environmental knowledge is worth examining.

In contrast to studies of the environmental consciousness of college students, which was treated as an element of this group's subjectivity and agency, research on the ecological consciousness of school children treated it more as an object of potential pedagogical interactions than as their own awareness and the decision-making of this group deriving from it. However, a qualitative change in the functioning of this social group is related to the development of environmental consciousness.

Adolescents at high school level stand on the threshold of adulthood and are equipped with the capacity to become progressively astute consumers who prioritize eco-conscious choices in their day-to-day activities. Moreover, these individuals are vocal advocates for significant matters, notably environmental concerns, reflecting their engagement with pivotal issues.

In this context, the participation of Polish youth in the climate strike is interesting. The international movement initiated in 2018 by the Swedish schoolgirl Greta Thunberg (Erman, Erman, Thunberg, Thunberg, 2019; Kisielewska, 2021; Markiewka, 2021) against the passivity of politicians towards global warming and climate change took the form of the Youth Climate Strike, which took place also in Poland. In 2019, it took place in several dozen Polish cities (73). Young people, mainly high school students, protested by going out into the streets (Korzeniowski, 2019). It is worth asking whether young people walking with banners such as "There's no planet B" are actually aware of the situation on Earth in terms of the state of the natural environment. Where do young people get their knowledge from? These questions became one of the inspirations for the presented study.

2. Literature review

One of the pioneering studies of environmental awareness of high school students in Poland was the research conducted in 1988-1992 under the supervision of Danuta Cichy. The research group consisted of 2966 people. 53.9% were students of general, vocational, and technical education secondary schools (Cichy, 1993). Young people were asked about their attitudes towards the natural environment, about who or what determined their attitude towards the environment, and about their understanding of the state of environmental degradation, i.e. air, water, and soil. The examined youth showed a large interest in environmental problems. Their attitude towards the environment was influenced, first and foremost by mass media, then by school and home.

The environmental awareness and knowledge of young people, has been the subject of interest of other researchers in Poland. Pupils at various stages of education, including high school and technical secondary school students, were studied by Jan Frątczak (Frątczak, 1995). Students were asked about their knowledge of such concepts as ecology, ecosystem, and biocenosis. Understanding of these terms turned out to be low. Other questions posed to the participants concerned their opinions on the threat to the environment in Poland, the threat of an ecological disaster, and the readiness of young people for pro-environmental activities, which turned out not to be very high. However, these studies were concerned more with ecological concepts and young people's beliefs than with actual knowledge about the state of the environment and the impact of pollution.

Another study on the knowledge and opinions of high school students (along with university students) was conducted by Ryszard Kowalski, Maria Obrębska and Renata Stoczkowska (Kowalski, Obrębska, Stoczkowska, 1997). The environmental awareness of high school students in Starachowice was studied by Renata Borek-Wojciechowska and Janina Malinowska (Borek-Wojciechowska, Malinowska, 2002). Students were asked about the knowledge of concepts and terms related to ecology and the environment, air, water, soil pollution, waste, and environmental protection. Students were also asked about pro-ecological attitudes. The researchers found the students' knowledge to be sufficient, and assessed their attitudes, especially towards waste management, highly.

Aleksandra Kuzior (Kuzior, 2005) studied the presence of such a component as sustainable development in ecological awareness. Analyzing curricula at various levels of education in terms of their content concerning sustainable development, she conducted a study on a group of 350 students. 61% of the respondents were middle school and high school students. All of the respondents had no knowledge of sustainable development. More than half of the respondents claimed that the environment should not be exploited in an unrestricted way, but almost half were of the opposite opinion.

Another study on the environmental knowledge, sensitivity, and pro-ecological behavior of young people was conducted by Mariusz Gajewski (Gajewski, 2007). 246 students from 3 high schools in the Lesser Poland Voivodeship and 3 high schools in the Świętokrzyskie Voivodeship were presented with a questionnaire formed of 9 questions. Among these were questions about the area with the highest regime, about issues related to the greenhouse effect, inter-species relationships, and inexhaustible natural resources. The study showed that the ecological knowledge of the participants' was in many cases at a fairly high level, but did not translate into undertaking pro-ecological actions in practice.

In 2019, a study was conducted on a group of 419 students aged between 16-19 years of age, living in the city of Bełchatów and its vicinity. The participants were asked, among other things, about their assessment of the state of the natural environment, the biggest ecological problems, both globally and in their place of residence, their perception of Poland's role in environmental protection activities, ecological awareness and behavior, sources of knowledge about environmental protection, and their attitudes towards climate change and climate strikes. The study did not test for specific knowledge, but rather the opinions and attitudes of young people towards various environmental problems. The study showed, however, i.a. an evident lack of awareness of the threat of water shortages in Poland, which indicates there is a lack of knowledge about the unfavorable situation of Poland, which, has the lowest rate of water availability in all of Europe. The study showed that the participants had an awareness of the threats related to issues such as the degradation of the natural environment or climate change. However, the young people participating in the study were not aware of threats such as the water shortages mentioned above or the depletion of natural resources. The sources of knowledge about environmental protection which these young people drew from were the Internet (74%) and social media (58%). The perception of ecological problems is therefore shaped primarily by the media. Only 44% quoted school as a source of knowledge about the environment, and schools only came fourth in the ranking. (Results of the survey of environmental awareness among young people living in Bełchatów and its vicinity, 2019).

The Report-Debutants 23, which was a survey conducted in May 2023 on a group of 1000 people aged 18-21 who can take part in elections for the first time this year, shed some interesting light on the problem. In addition to perspectives on political matters, the report presents the stances, attitudes, and values expressed by the participants, encompassing their perspectives on environmental concerns as well. Ecology was ranked as the 25th most important value out of the 29 listed. 59% of the participants were concerned by air pollution, climate change, and biodiversity loss. However, 34% of the participants declared that they were bored with talking about ecological or environmental issues all the time. According to young people participating in the study, it is the responsibility of politicians actively address and mitigate the impending climate catastrophe. 27% of participants believe that Poland's natural environment is in a good state (this was the answer indicated by the largest percentage of participants), while 13% believed that its state is average. Only 21% of participants believed that the natural

environment in Poland was in a bad state of preservation and damage (Debiutanci'23, 2023). It can be assumed that such an assessment results from the participants having only superficial knowledge about the state of the natural environment. It would be worth investigating the level of more detailed knowledge about the environment, and the causes and effects of pollution among students.

Research on the knowledge or pro-environmental attitudes of young people has been conducted in various countries. One such study conducted in the United States indicated a low level of knowledge among students (Gambro, Switzky, 1996). In Lebanon, a study on environmental knowledge was carried out with 660 students and was conducted by means of a test. The questions in the test covered topics such as environmental pollution, waste recycling, water quantity and quality, and animals. It showed the presence of pro-ecological attitudes among the youth, but gaps in knowledge (Makki, Abd-El-Khalick, Boujaoude, 2003). There have also been more recent studies concerning the ecological knowledge of young people. In the Czech Republic, a study was carried out on both knowledge as well as on attitudes and beliefs. Over 25,000 students participated in this study. The test included questions about ecological concepts, environmental problems such as climate change, and knowledge of pro-ecological activities (Činčera, Kroufek, Bogner, 2022). Another study, focusing on the attitudes of the students, was carried out in Spain. The results of the study were intended to be used in planning environmental education. The questions in the questionnaire concerned both preferences for school teaching and non-formal education, e.g. watching documentaries, or talking about the environment with parents or carers. The study showed students' concerns about the deteriorating environment, but this did not translate into a greater willingness to learn or take action, for example through participating in pro-environmental demonstrations (Muñoz-García, Alcántara-Manzanares, Medina Quintana, 2022).

The issue of the sources of knowledge is of great interest and importance. In a study involving students of pedagogy, it turned out that social media is the main source of knowledge about the natural environment and its protection (Ciążela, 2021a). School and university, on the other hand, were indicated as a source by only a small percentage of respondents.

Besides formal education, informal education occurs. Social campaigns are a good example of this. However, previous studies have shown that awareness of environmental campaigns tends to be low (Ciążela, Tuszyńska, 2019; Ciążela, 2021b). The aforementioned study with students of pedagogy showed that the participants knew of only a few of the mentioned social campaigns which were taking a short time before the study was conducted. They also found it difficult to answer questions about the subject of the campaigns, the place where the campaigns were taking place, nor about the people participating in them (Ciążela, 2019). A study involving 250 students from various faculties showed that campaigns which the students were familiar with were those that had been running for a long time, and which are present in numerous locations (Ciążela, 2021b). In both studies, the participants claimed to remember social

campaigns which had, in fact, never existed and were invented only for the purposes of the study to be listed in the questionnaires (Ciążela, Tuszyńska, 2019; Ciążela, 2021b).

3. Materials and method

The aim of the study was to assess the level of knowledge about the natural environment and its preservation among both, general and technical secondary school students. Furthermore, the study aimed to ascertain the sources from which students acquired knowledge on this subject.

The research group consisted of 710 people aged 15-20 of age (342 women, 368 men, average age 17.22). They were students of general and technical high schools in various cities in Poland. 458 of the participants were students at general secondary schools (231 women, 227 men, average age 17.35) from the Warsaw agglomeration and the city of Toruń. 252 were technical students from Olsztyn, Zabrze, and Serock (111 women, 141 men, average age 16.97).

The first part of the study was a multiple-choice test consisting of 20 questions on the state of the natural environment, the causes, and effects of pollution, and the strategies to preserve it. The question set used in the study was the same as that used for the doctoral thesis, the results of which were published in "Zeszyty Naukowe Politechniki Śląskiej" in 2018 (Ciążela). The substantive correctness of the questions was then consulted with lecturers from the Warsaw University of Life Sciences. Following this, some of the questions were changed in order to test the knowledge of new, more current issues. Some questions have been changed to reflect more familiarity with the state of the environment, including the percentage of wild animals living in the world, rather than knowing about one particular endangered species. The question about smog was changed because of the results obtained in another study conducted with the participation pedagogy students (Ciążela, 2021a). At that time, when asked what the slogan "zero-emission" meant - an almost identical percentage of students answered that it was about emitting carbon dioxide (39.3%) and emitting gases causing smog (38.6%) (Ciążela, 2021b), which may indicate an overlap of these issues in the minds of the respondents. The questions were divided into four thematic groups.

Questions about the causes of the global ecological crisis:

6. The theory explaining "global warming of the climate" by human activity considers the following as the cause of warming: a) the creation of the ozone hole, b) the exploitation of fossil fuels leading to CO₂ emissions, c) the development of nuclear energy, d) I don't know.
11. The ozone hole is the result of: a) the production and emission of freon by humans, b) the emission of CO₂ by humans, c) the release of freon in the process of melting glaciers, d) I don't know

17. The causes of ocean acidification are: a) dumping plastic waste in the oceans, b) melting glaciers, c) overfishing, d) I don't know.

13. By polluting water reservoirs with sewage, humans contribute to the excessive growth of algae, which may result in: a) water hardness, b) gradual transformation of the lake into a swamp or peat bog, c) an increase in fish population, d) I don't know.

Questions about the level of environmental devastation:

5. What percentage of mammals living on Earth are wild animals: a) 4%, b) 15%, c) 23%, d) I don't know

12. What percentage of the Earth's water is drinking water: a) 1%, b) 10%, c) 33%, d) I don't know.

Questions about the impact of the devastation of the natural environment on the global ecosystem and for humanity:

1. The thawing of permafrost in Siberia and Alaska will result in: a) an increase in freon emissions into the atmosphere, b) an increase in methane emissions into the atmosphere, c) an increase in sulfur dioxide emissions into the atmosphere, d) I don't know.

8. The extinction of bees will have catastrophic consequences for humans, because: a) there will be no honey as an important component of the diet, b) the disappearance of bees will cause colonies of rival wasps to develop, c) bee-pollinated plants will disappear, d) I don't know.

10. Acidification of the oceans can lead to: a) acid rain and, as a result, the destruction of coastal areas, b) a decrease in the population of plankton and, as a result, disruption of many food chains, c) cooling of the climate, d) I don't know.

14. If, as a result of climate warming, the water level rises, the consequence for Poland may be: a) an increase in the amount of drinking water, b) a decrease in land habitation in northern Poland, c) no consequences for Poland, d) I don't know.

15. The effects of the ozone hole are manifested in humans by: a) respiratory and heart diseases, b) weakening of bones and teeth, c) skin cancers and eye diseases, d) I don't know.

16. Humanity, by causing global warming, contributes to: a) more frequent hurricanes, b) more frequent volcanic eruptions, c) earthquakes, d) I don't know.

18. Air pollution from car exhausts: a) can cause a child to be born without limbs, b) can cause brain damage to the fetus, c) poses no threat to the fetus in the mother's womb, d) I don't know.

Questions about how to counteract the ecological crisis:

2. Which of the following raw materials is considered the most slowly renewable raw material? a) oil, b) water, c) wood, d) I don't know.

3. Greenhouse gas emissions can be reduced by: a) reducing meat consumption, b) saving water, c) reducing sugar consumption, d) I don't know.

4. Transitioning from personal car usage to public transport on a daily basis by part of society: a) is enough to solve the problem environmental pollution, b) will bring some small benefits for improving the state of the environment, c) will not bring any benefits for the environment if it is not undertaken by the majority of the society, d) I don't know.
7. Striving to reduce smog is aimed at: a) combating global warming, b) improving the health of people exposed to smog inhalation, c) preventing weather changes caused by smog, d) I don't know.
9. Undertaking the program of reducing greenhouse gas emissions by only a few of the countries emitting greenhouse gases: a) will destroy the entire project, b) will reduce the effectiveness of the project, but will not make it meaningless, c) the answer depends on how many and how large emitters will participate in the program, d) I don't know.
19. Glass packaging is better than cans because a) they are easy to reuse, b) they take up less space as garbage than cans, c) they decompose faster, d) I don't know.
20. In order to decrease "power consumption": a) just disconnect the phone from the charger, b) you need to remove the charger from the socket, c) the effects of both actions are the same, d) I don't know.

The second part of the study consisted of questions about the sources from which the participants gained knowledge about environmental preservation. The list of sources included: school, television, news portals, social media, and social campaigns. Participants were also asked about their most important source of knowledge about environmental protection.

4. Results

The level of knowledge of high school students turned out to be higher than the level of knowledge of technical students. The average result obtained in the test by high school students is 13.21, and by technical education secondary school students -9.47.

Table 1.

The level of knowledge

	n	M	SD	Median	Min	Max
All	710	11.88	4.035	12	0	20
High school	458	13.21	3.298	13	0	20
Technical	252	9.47	4.137	10	0	20

The level of knowledge was not related to age. The correlation turned out to be significant, but low ($\rho = 0.115$, $p < 0.01$). In the case of high school and technical education secondary school students, there was no statistically significant correlation between age and the level of knowledge.

Table 2.*The percentage of correct answers*

No.	Question	Correct answers	%
8	The extinction of bees will also have catastrophic...	618	87
19	Glass packaging is better than cans because...	589	83
14	If, as a result of climate warming, the water level rises...	586	82.5
13	By polluting water reservoirs with sewage, man contributes...	527	74
17	The causes of ocean acidification are...	510	72
15	The effects of the ozone hole are manifested in humans by...	464	65
20	In order to save "power consumption"...	462	65
2	Which of the following raw materials is considered...	440	62
7	Striving to reduce smog is aimed at...	431	61
10	Acidification of the oceans can lead to...	424	60
18	Air pollution from car exhaust...	419	59
11	The ozone hole is the result of...	410	58
3	Greenhouse gas emissions can be reduced by...	399	56
4	Resignation by part of society from using their own cars...	392	55
6	The theory explaining "global warming of the climate"...	376	53
9	Undertaking the program of reducing greenhouse gas ...	356	50
16	Humanity, by causing global warming, contributes to...	344	48.5
12	What percentage of the Earth's water is drinking water...	334	47
1	The effect of the thawing of permafrost in Siberia and Alaska...	206	29
5	What percentage of mammals living on Earth...	151	21

Most students knew the answers to questions concerning the effects of the extinction of bees, glass packaging and the effects of rising water levels due to global warming. Unfortunately, students had very little knowledge of the number of wild mammals living on Earth, the effects of thawing permafrost in Siberia and Alaska, and how much drinking water is on Earth.

Table 3.*The percentage of correct answers*

Question	All (710)	%	High school (458)	%	Technical education (252)	%
1	206	29	145	32	61	24
2	440	62	312	68	128	51
3	399	56	312	68	87	34.5
4	392	55	245	55.5	138	55
5	151	21	116	25	35	14
6	376	53	292	64	84	33
7	431	61	284	62	147	58
8	618	87	432	94	186	74
9	356	50	248	54	108	43
10	424	60	305	67	119	47
11	410	58	313	68	97	38.5
12	334	47	256	56	78	31
13	527	74	360	79	167	66
14	586	82.5	417	91	169	67
15	464	65	350	76	114	45
16	344	48.5	265	58	79	31
17	510	72	348	76	162	64
18	419	59	301	66	118	47
19	589	83	414	90	175	69
20	462	65	327	71	135	54

The source of knowledge indicated by the largest number of participants turned out to be social campaigns (73%). Information portals (57%) came second. School as a source of information on environmental protection was ranked only third (52%). A similar percentage of participants indicated television (37.5%) and social campaigns (36%) as sources of knowledge about environmental protection.

Students at technical education secondary schools generally indicated a smaller number of sources from which they obtain knowledge than students at general secondary schools. 79% of high school students declared gaining knowledge from social media, while in the case of technical secondary school students, it was 62%. 62% of high school students and only 48% of technical education secondary school students indicated information portals. In the case of school as a source of knowledge, it was indicated by 56% of high school students and 46% of technical education secondary school students. A higher percentage of technical education secondary school students (40.5%) compared to high school students (36%) indicated television as a source of knowledge. Almost twice as many high school students as technical education high school students indicated social campaigns as a source of knowledge about environmental preservation - 43% and 22%, respectively.

Other sources cited by study participants included:

- Internet (Internet in general);
- YouTube;
- Wikipedia;
- podcasts;
- documentaries (films/series on streaming services, e.g. Netflix);
- books;
- friends,
- parents (family);
- Center for Civic Education.

Table 4.

What are your sources of knowledge about environmental preservation?

Source	All (710)	%	High School (458)	%	Technical Education (252)	%
School	372	52	255	56	117	46
Television	266	37.5	164	36	102	40.5
News portals	406	57	284	62	122	48
Social media	519	73	362	79	157	62
Social campaigns	255	36	199	43	56	22

The highest percentage of participants indicated social media as their most important source of knowledge on environmental preservation (44%). Information portals (20%) came second. School was indicated to be the most important source of knowledge by only 16% of the participants. Television and social campaigns were indicated by a similar number of participants - 6.5% and 6%, respectively.

The highest percentage of both general and technical education high school students indicated social media as the most important source of knowledge - 45% and 42%, respectively. Information portals were rated second highest, indicated by 21% of high school students and 17.5% of technical education secondary school students. Only 17% of high school students and 15% of technical secondary school students indicated school as the most important source of knowledge on environmental preservation. 11.5% of technical education secondary school students indicated television as the most important source of knowledge, while in the case of high school students - only 4%. The situation is the opposite in the case of social campaigns - 8% of high school students and only 4% of technical secondary school students indicated them as the most important source.

Table 5.

What is your most important source of knowledge about environmental protection?

Source	All (710)	%	High School (458)	%	Technical Education (252)	%
School	115	16	78	17	37	15
Television	46	6.5	17	4	29	11.5
News portals	140	20	96	21	44	17.5
Social media	314	44	208	45	106	42
Social campaigns	44	6	35	8	9	4
Other	51	7	24	5	27	11

5. Discussion

The level of knowledge of general secondary school students turned out to be similar to that of university students (Ciązela, 2018; Ciązela, 2021c).

Question 1, which concerned the release of methane, was answered by a relatively small percentage of participants. This is probably because the issue has been publicized only relatively recently and has not yet become firmly established in the minds of the respondents.

Only 56% of participants answered question 2 correctly, namely that greenhouse gas emissions can be reduced by reducing meat consumption. The need to reduce meat consumption has recently gained more attention. Meat replacement products are also beginning to appear more widely and to be advertised. The reason for the responses might not be only due to lack of knowledge but also the deep-rooted tradition of meat consumption in Poland. The relatively low awareness of the problem with meat consumption may also be evidenced by the fact that, as stated by the authors of the *Debiutanci'23* report, only 15% of participants indicated that the promotion of attitudes aimed at limiting the production and consumption of animal products is a priority issue related to environmental preservation. For the purpose of comparison, it is worth recalling that the issue of limiting deforestation was indicated by 47% of participants (*Debiutanci'23*, 2023).

Question 5 regarding the global number of wild animals was answered correctly by the lowest percentage of participants. This may be interpreted to mean that this issue is rarely discussed. The numerous campaigns concerning the protection of endangered species turn out to fall short of effectively raising the awareness of young people about the scale of the problem. Naming one particular endangered species of bird turned out to be less challenging for the students. The correct answer was then given by 55% of the participants (Ciążela, 2018).

Question 6 concerns the causes of global warming. In 2018, this was the question that was answered correctly by the lowest percentage of all – only 44% of participants. Now that the topic of global warming has become one of the most pressing, the proportion of people who answered correctly is higher, but not significantly so, and still lower than many other questions in this survey. The significantly higher percentage of correct answers among students at general secondary schools (64%) than among technical education secondary students (33%) is also puzzling.

Only 47% of the participants correctly answered the question about the amount of drinking water in the world. As in the previous case, there is a significant disproportion between the percentage of correct answers given by students at general secondary schools (56%) and of technical education secondary schools (31%). When the question was posed to university students it was phrased less specifically, asking whether drinking water is scarce on all continents or only in Africa, rather than asking for a specific amount. Nevertheless, only 51% of participants provided the correct answer (Ciążela, 2018). In the same vein, only 25% of the participants in the study presented in the *Debiutanci'23* report indicated that the reduction of water consumption by industry, cities, or individual recipients is a priority issue related to environmental preservation in Poland (*Debiutanci'23*, 2023).

Only 49% of the participants correctly answered the question regarding the effects of global warming, i.e., more frequent hurricanes. This question was also challenging for the university students. Only 44.5% of university students answered it correctly, making it the question with the second lowest result (Ciążela, 2018). According to the *Debutants'23* report, young people are afraid of the consequences of climate change, which include e.g., hurricanes, but also droughts, heatwaves, and floods - 33% of participants are afraid. 30% of participants are concerned about the state of the environment, and 23% about the loss of biodiversity. 72%, on the other hand, are afraid of inflation, followed by problems such as personal financial and material situations or unemployment. The authors of the report, however, point out that issues such as inflation and the increase in the cost of living, as well as e.g., the influx of refugees to Poland are also indirect consequences of an environmental disaster (*Debiutanci'23*, 2023).

60% of the participants correctly answered question no. 7 on smog: the fight against smog is aimed at improving the health of people exposed to its inhalation. The question about smog in the study with students concerned the effects of heating a flat with a traditional fireplace or stove. 65% of students answered correctly: heating a flat with a traditional fireplace or stove causes smog. The survey with the participation of university students was conducted before the

smog alert was announced in Poland. In the meantime, there were numerous campaigns regarding the causes of smog, so it was decided to change the question. However, the question remains to what extent young people are aware of the problem and its importance. As part of the research presented in the Debutants report, the participants were asked what points of the electoral program their ideal party should consider. Only 11% indicated that strengthening anti-smog resolutions was such a point, while a slightly smaller percentage (9%) would be in favor of complete abolition of restrictions on what we use to heat houses and apartments (Debiutanci'23, 2023).

The idea to change the question about smog resulted from an interesting result obtained in a study involving students of pedagogy. An almost identical percentage of students answered that "zero-emission" refers to the emission of carbon dioxide (39.3%) and the emission of gases causing smog (38.6%) (Ciążela, 2021b), which may indicate that these issues overlap in the minds of the respondents. Furthermore, as many as 20% of high school and technical high school students answered that the fight against smog is aimed at fighting global warming.

More than 80% of the participants indicated that sources of knowledge other than school as the most important. In a study involving students of pedagogy, the results were similar: social media turned out to be the most important source of knowledge for 55.7% of participants. Information portals came second, with a score of 44.3% (Ciążela, 2021a). A study conducted in the 1990s, before the widespread use of the Internet, also showed that school was not the most important source of knowledge for high school students. School education as a source of ecological knowledge was indicated by 40% while 85% of participants indicated the press as their main source, and 50% indicated radio broadcasts (Frątczak, 1995).

Learning from sources other than formal education can be a positive phenomenon because it shows the willingness to explore the issues on one's own. In addition, it proves that the issues are visible in the public sphere, thanks to which people interested in the subject can supplement their knowledge. The Debutants report also mentions the fact that young people draw knowledge from various sources. Online sources, such as podcasts and blogs, are more often used by men. Women, on the other hand, more often listen to information services on television, as well as gain knowledge from contacts with family and friends. In turn, social media are the most popular among young people who are still dependent on their parents (Debiutanci '23, 2023).

More numerous indications of television as a source of knowledge by students at technical education secondary schools may result from a more traditional lifestyle. It may also suggest less independent searching for information. It cannot be ruled out that technical education secondary school students are more focused on acquiring knowledge related to the particular profession for which they are preparing. Although television is currently less and less popular among young people and is taking a back seat to the popularity of the Internet, it is worth remembering that you can still find valuable documentaries on it.

The lower percentage of indications of social campaigns as a source of knowledge among students at technical education schools is puzzling. Perhaps this might be related to their places of residence, where the distribution of social campaigns is smaller. It might also be due to a lack of interest in social campaigns.

Social campaigns are a source of valuable information and have at their disposal means of communication inaccessible to formal education, such as humor, appeals to emotions, or the participation of celebrities. Perhaps, the problem is their ineffective distribution. Creators of social campaigns should think not only of interesting and memorable forms of communication, but also about their reach. It might be worthwhile, perhaps, to use social media (the popularity of which was also proven by this study), or think of more unusual forms of reaching the audience. An example is the Smartphone Zombies campaign, where inscriptions were placed on the pavement so that they were within sight of people looking at their phones.

There are various reasons why participants might have indicated sources other than school as the most important. Perhaps the knowledge provided in school is insufficient. It may, however, also be that other sources are preferred because they are in a more attractive and appealing form to young people. In addition to a more lively and attractive form of communication, social media also give you the opportunity to express your opinion, not only by commenting on the content, but also by posting photos, etc. The same applies to some modern social campaigns in which you can actively participate by, for example, posting a photo on social media (An example is the social campaign #LINIA PROSTA (Straight line), where photos were posted with a line painted on a hand as a sign of solidarity with people with Down syndrome, but also the pro-environmental campaign First day without smog, where users could record and upload their own video of holding one's breath.)

It is worth remembering that we tend to remember better what we actively participate in. We also remember better when we have an interest in the topic, or if it is related to a certain emotional involvement. The presence of social media in the first place, as in the study with students of pedagogy (Ciążela, 2021a), also shows how important social media is in the lives of young people. This should not be underestimated. Perhaps it is worth increasing and promoting the offer of environmental education on social media and even taking steps to ensure the reliability of the content present there.

In addition, it is worth emphasizing that many valuable resources may be found on the Internet, such as the "Climate Science" portal. What is worrying, however, is the fact that students indicated social media rather than news and information portals as their most important source. This is troubling because the content we deal with on social media, is highly subjective, i.e., the selection of content is created by participants, and linked to the knowledge, or lack thereof, and the views of the users themselves. Despite the publication of the IPCC Report, environmental preservation is still a subject of doubt and controversy. There are many skeptics or even critics of this issue, such as denialists and climate deniers. As a result, there are articles criticizing the activities of environmentalists. These articles usually do not refer to any scientific research.

False information, the so-called ‘fake news’, also appears on social media. Facebook's introduction of marking untrue information as fake news does not solve the problem. A recent study shows that marking some information as fake news increases the perception of other information as credible, regardless of whether it is indeed so. This phenomenon has been called the implied truth effect (Pennycook et al. 2020). Another popular form of communication, memes, are also popular on social media. They are often used to make fun of current events or people. While some memes are more or less accurate satirical comments, some are often at a very poor level and even hurt specific individuals, which can affect the recipients' emotions and contribute to the formation of negative attitudes¹.

A potentially dangerous phenomenon is also the so-called ‘sleeper effect’, which consists in dissociating the content of information and the source from which it comes over a period of time (Hovland, Weiss, 1951; Pratkanis et al., 1988). The result of this phenomenon is an increase in the persuasive impact of information, even in the case of information coming from a source considered unreliable by the recipient. This is because after some time the recipients only remember the content, but not the source of the information. The phenomenon can be particularly unfavorable when it comes to Internet use, including sources such as social networking sites, as well as discussion forums and blogs of other users. The lack of selection of the obtained information leads to an increase in the strength of unreliable information because after some time the user only remembers that he or she "read it somewhere on the Internet". This phenomenon may also gain strength in the absence of systematic knowledge on environmental preservation.

Therefore, it should be clearly emphasized that none of the above-mentioned arguments in favor of informal environmental education removes the duty to implement thorough environmental education as part of a formal education in a Polish school.

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¹ Many memes refer to someone's appearance; for example. An example is a high-profile case when the creator of the meme saw the similarity of the Turkish president to Gollum from the film series "The Lord of the Rings" (dir. Peter Jackson), for which he was accused of insulting the head of state (Barrel, 2015). There are hundreds of such memes on social media. Even if they go unnoticed in the form of, for example, accusations of defamation, they often have an impact on the negative attitudes of recipients.

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