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## **ECOLOGICAL AWARENESS AMONG SECONDARY SCHOOL PUPILS**

**Abstract:** *This paper presents the results of quantitative research to survey ecological awareness among pupils in terms of three interlinked components: knowledge, attitudes and behavior. The survey participants were 529 secondary school pupils from the city of Zagreb, and the instrument used was a survey questionnaire. The analysis of the results shows that Zagreb secondary school pupils are environmentally aware to some extent but that there is room for improvement in regard to their familiarity with certain concepts in the area of ecology and changing behavior related to environmental protection. The survey identified statistically significant differences in pro-environmental behavior among respondents based on gender and class year in a number of situations. The results indicate the need to continually work on raising awareness of ecological issues and environmental protection, especially in terms of familiarising pupils with fundamental ecological concepts and pro-environmental behavior.*

**Keywords:** *ecology, ecological issues, curriculum, formation, education, environmental protection*

## **INTRODUCTION**

Over the past few decades, the development of technology and the economy has significantly improved people's quality of life. However, it has also led to an irrational relationship between humans and nature, causing uncontrolled exploitation of natural resources and inadequate care for the environment in which humans live. According to Cifrić (2006), this relationship that humans have toward nature is typical of anthropocentrism, a value-theory view stemming from the idea that humans are superior to nature because they are the most developed beings on Earth. Numerous authors agree that the start of the industrial revolution meant that humans became one of the most important factors in environmental pollution (Anđić, 2007; Colby, 1991; Husić, 2021; Krznar, 2008; Oldfield, 1983; Ryke, 1987; Seymour, 2016). Urbanisation, technological advancement, growth of the world population, and the development of a consumeristic lifestyle are just some of the human-caused problems directly influencing environmental changes. For instance, the increase in industrial production over the last few decades has increased water, air and soil pollution due to various chemicals, pesticides and chemical fertilizers (FAO and IWMI, 2017; Čuvalo, 2021). Moreover, the continual use of energy sources based on fossil fuels has caused a greenhouse effect and the onset of ozone holes, which has led to creating heatwaves, melting of glaciers, acidification of the oceans, and the dying coral reefs (Kerr, 2007). In addition, exponential population growth has led to excessive exploitation of natural resources, negatively impacting biological diversity. Estimates indicate that in the last 50 or so years, the vertebrate population has decreased by 68% and that today, almost 90% of

the world's sea fish stock is entirely or excessively exhausted (WWF, 2020). Moreover, the felling of forest trees or deforestation for repurposing land for agricultural uses has resulted in soil erosion, lower humidity levels and higher surface temperatures (Laurance, 1999).

The problems associated with exploitation and pollution of the environment represent not only negative consequences of scientific and technological progress in contemporary society. However, they are also directly linked to an increasingly deteriorating quality of life and an increasing number of those suffering from various diseases. For instance, the European Environment Agency (EEA) report for 2020 cited that the number of those suffering from respiratory and cardiovascular illnesses increases due to increasing air pollution. This fact is supported by data from the World Health Organization (WHO), indicating that air pollution is the leading cause of 400,000 premature deaths a year (WHO, 2018, according to the European Environment Agency, 2020). Furthermore, chemical pollutants in water containing arsenic, mercury, lead and fluoride cause migraines, fatigue, nausea and skin disorders but also serious conditions such as leukemia, disorders in the reproductive organs, kidney and liver damage, as well as the failure of the central nervous system (Mishra et al., 2016; Singh & Gupta, 2017). The direct consequences of environmental pollution primarily impact impoverished communities because their survival depends on natural resources; hence, it often happens that they excessively exploit such resources in a damaging and unsustainable manner.

Accordingly, over the last few decades, the international community has made significant efforts to raise awareness of ecological issues and adequately address related socioeconomic and health issues (Hopwood et al., 2005). This led to the first international environmental conference held in 1972 in Stockholm, which produced the Stockholm Declaration and established the UN Environmental Program (UNEP). Twelve years later, in 1992, the conference in Rio de Janeiro was held, resulting in the adoption of Agenda 21, i.e., an action plan directed toward sustainable development of ongoing environmental protection. The United Nations Framework Convention on Climate Change resulted in the acceptance of the Kyoto Protocol, which aimed to reduce carbon dioxide emissions and other types of greenhouse gases. The dawn of the millennium saw a greater acceptance of the underlying idea of sustainable development as the best solution to growing ecological problems. The fundamental presumption of this concept is the sustainable utilization of natural resources in a manner that satisfies current needs while not jeopardising the needs of future generations (Brundtland, 1987, as cited in Gudmanian et al., 2020). Accordingly, in the period from 2000 to 2015, a number of larger conferences were held on sustainable development (2002 World Summit on Sustainable Development in Johannesburg, 2012 United Nations Conference on Sustainable Development in Rio de Janeiro and the United Nations Sustainable Development Summit 2015). Continuing with Agenda 2 in 2000, the Millennium Development Goals (MDGs) were adopted at the United Nations Millennium Summit. The most important of the eight main goals is MDG 7: Ensure Environmental Sustainability, mainly related to solving ecological problems, even though the goals are intertwined. This goal aims to solve the problem associated with the loss of biological diversity, insufficient implementation of the principle of sustainable development in national policies and programs, and access to drinkable water and basic sanitary conditions in the poorest areas. Fifteen years later, the 2030 Sustainable Development Agenda was adopted, providing 17 new goals called Sustainable Development Goals (SDGs). The goals for environmental protection are directed at achieving sustainable consumption and production, sustainable management of natural resources, and undertaking urgent actions in combatting climate change (UN 2015). The Agenda also emphasizes the need to mitigate the negative influences of urban life through the efficient use of water and energy and reduce water pollution due to chemicals. In the same year, the twenty-first session of the Conference of the Parties (COP21) on climate change was also held in which the Paris Agreement (Paris Climate Accords) was adopted. The agreement aims to halt the increase in the global average temperature (UNFCCC, 2021). Finally, last year in Glasgow, the Twenty-Sixth UN Climate Change Conference of the Parties (COP26) was held. Several decisions were made, including reducing global emissions of greenhouse gases and carbon dioxide by 45% by 2030, combatting methane emissions, gradually reducing the use of energy from coal, eliminating subsidies for fossil fuels and reducing excessive deforestation of forests.

Support for global endeavours in preserving and protecting the environment also included the European Union with ecological policies dating back to the 1970s. The European Union announced at

that time a series of conventions, such as the Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea (1974), Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution (1976), Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979), and later the Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992) and the Convention on the Protection of the Alps (1995). The European Union is a signatory to all of the most important conventions and declarations on environmental protection established at the global level. In 2020, the EU presented its strategic framework called the European Green Deal (Communication from the Commission, 2020), providing measures for the efficient exploitation of resources, halting climate change, renewing biological diversity and reducing pollution by transitioning to a clean circular economy.

As part of the international and European community, Croatia has been following global trends and providing support in solving ecological problems. In addition to legislative provisions, such as the Environmental Protection Act and the Act on Protection Against Light Pollution, environmental protection has been incorporated into national strategic frameworks since the beginning of Croatia as an independent country. Accordingly, in 1992, the Declaration on Environmental Protection was adopted, and ten years later, the National Environmental Action Plan (2002). Moreover, in 2005, the Waste Management Strategy was announced, followed by the Strategy and Action Plan for the Protection of Biological and Landscape Diversity in 2008 and the Sustainable Development Strategy in 2009. Ecological challenges and the concept of sustainability are part of the most recent National Development Strategy of the Republic of Croatia to 2030, which was passed in 2021. The Strategy cites four main directions of development: (1) sustainable economy and society, (2) strengthening resilience to crises, (3) uniform regional development, and (4) a green and digital transition (National Development Strategy, 2021). In terms of the most recent direction of development, the focus is placed on ecological and energy transition toward climate neutrality, self-sufficiency in food production, development of the bioeconomy and sustainable mobility.

However, despite endeavours from the international community and support from global civil society organizations to mitigate the effects of human impact on the environment, available data indicate that ecological problems are not only inadequately addressed but are also increasing due to wars, migration and overpopulation (UN, 2019). Consequently, there is increasing talk about the need for developing an ecologically aware global society that will, in line with knowledge, attitudes and behavior, intensify action for the protection and preservation of the environment while keeping in mind the link between ecological challenges and global problems associated with poverty and inequality. According to some authors (Cifrić, 2012; Li, 2018; Vickers, 1999), ecological awareness can be defined as a combination of personal awareness and systematic reflection on the environment and includes, in addition to knowledge of environmental issues, pro-environmental behavior. Bolscho (1996) mentioned three key components of ecological awareness: (1) perception of ecological issues, (2) value orientation, and (3) intentional behavior and action. McBride et al. (2013) include knowledge, skills and motivation for work in solving current issues and preventing new ones. A similar line of thought was presented by Scott and Vare (2020), who pointed out that basic ecological awareness comprises knowledge, followed by interaction and singularity between nature and humans, standards and rules of behavior in nature, ability to properly assess the consequences of others' and one's actions toward the environment, motivation for participating in environmental protection activities and emotional sensitivity toward external surroundings. The importance of developing an ecological awareness comprising knowledge, attitudes and pro-environmental behavior has also been supported by recent research, which indicates that young people, although familiar with today's ecological issues, are not adequately informed of methods of preserving the environment or activities for protecting it (Abbas & Singh, 2014; Afrić, 2002; Dumbović, 2020).

Strengthening them further is necessary to face all ecological challenges in the future. The key role in this is education. Previšić (2008) mentioned that education is key to a radical change in people's attitudes toward the environment. Accordingly, Afrić (2002) noted that young people should become aware of the interdependency between development and the environment, sustainable development and its implementation, and current results to increase motivation for active participation in solving ecological issues and nurturing personal responsibility toward the environment. Similarly, Jukić (2011) noted that the primary tasks of ecological education should be to establish a harmonious relationship with the environment, which includes learning about natural processes, raising awareness

of the connectedness of global changes on Earth and their impact on man and the environment, and encouraging participation in changes. The author believes that ecological topics should become an integral part of the school curriculum and should not be limited to certain subjects in natural science, such as geography or biology.

The importance of education in solving environmental issues and raising ecological awareness has been recognized at the global level. In 2005, UNESCO declared the United Nations Decade of Education for Sustainable Development (2005–2014) (DESD), aiming to emphasize the role of education in the importance of sustainable development for contemporary life, assuming responsibility for global ecological changes, developing an ecological culture and the ability to make decisions in line with sustainable development. The final UNESCO report on the success of this initiative (2014) highlighted that the concept of sustainable development incorporates all aspects of education, including curricula, textbooks, school activities and projects, including institutional management. However, the report points out that further institutionalisation of sustainable development in education requires a thorough change in educational policies. This means that more relevant content and learning practices should be incorporated to ensure that all pupils possess the knowledge, attitudes and capacities to respond to the challenges of sustainability. Furthermore, work should continue building teacher capacities to systematically integrate content on sustainable development in teaching and learning.

The Republic of Croatia has recognized the importance of introducing ecological topics in education. Accordingly, the interdisciplinary subject curriculum *Sustainable Development for Primary and Secondary Schools in the Republic of Croatia* was introduced within newer educational reforms. The goal of this cross-curricular topic is to raise awareness and deepen understanding of certain issues relating to sustainability, developing critical thinking and innovative solutions in solving ecological issues, conforming behavior in everyday life to the concept of sustainability and nurturing skills and traits that contribute to developing a just society. In terms of the respective topic, pupils should acquire knowledge of the diversity of nature and complex relationships between individuals and the environment, reflect on the causes and consequences of impacts on nature, develop skills such as solidarity, empathy, responsibility and creative solutions to problems, and be proactive for the benefit of schools and the community, including future generations (Ministry of Science and Education, 2019).

Recent research at the global and national levels (Boon, 2016; Keleş, 2017; Tomas et al., 2017; as cited in Vukelić, Rončević and Vinković, 2018) shows that teachers are aware of the importance of education for sustainable development, which is confirmed by their positive attitudes and familiarity with topics in the field of environmental protection and preservation. Similarly, research conducted with pupils and students (Aleixo et al., 2021; Hassan et al., 2010; Hickman et al., 2021; Zwolińska et al., 2022) shows that they are aware of climate change and sustainable development goals and feel personal responsibility for the world in which they live.

## RESEARCH METHODOLOGY

Although there has been an increase in interest in the protection and preservation of the environment at the international, European and national levels, recent reports (UN, 2019) show that it is necessary to invest additional efforts in developing environmental awareness because inequalities in the world are increasing, and environmental issues are becoming more numerous. Raising ecological awareness is especially important for young generations because they are considered key actors in promoting a sustainable lifestyle, adopting ecologically acceptable practices and transforming society in line with an ecologically friendly future.

### *Research goals and hypotheses*

Consequently, a survey<sup>8</sup> was conducted to investigate the level of ecological awareness among secondary school pupils in the city of Zagreb, which included familiarity with fundamental

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<sup>8</sup> The research was carried out as part of the graduation thesis entitled "Ecological awareness of secondary school students in the city of Zagreb", defended on January 18, 2022 at the Faculty of Humanities and Social Sciences, University of Zagreb.

concepts in ecology, attitudes and behavior relating to the protection and preservation of the environment. The following hypotheses are presented in the paper:

- H1** Pupils believe they are familiar with concepts covering the protection and preservation of the environment.
- H2** Pupils express positive attitudes toward the protection and preservation of the environment.
- H3** Pupils express pro-environmental behavior.

In addition, the research wanted to examine whether there is a difference in the pro-environmental behavior of pupils with regard to gender and age. Namely, some research has shown that particular demographic factors influence pro-environmental behavior. For instance, the research of Zelezny et al. (2000) showed that women expressed stronger ecological attitudes and behavior than men, which includes greater care for nature, the biosphere and living beings, as well as a greater awareness of personal responsibility for the environment in which they live. Furthermore, a number of conducted studies showed a relationship between age and ecological behavior. On the one hand, research from the 1970s and 1980s showed that young people are more prone to expressing pro-environmental attitudes and behavior (Buttel, 1979; Hines et al., 1986; Liere and Dunlap; 1980; as cited in Smith & Kingston, 2021), whereas the most recent research has revealed the opposite, i.e., that older individuals are those affording more care to the protection and preservation of the environment with respect to young people (Wang et al., 2021; Wiernik et al., 2013, Wiernik et al., 2021; Xu et al., 2021). Based on the abovementioned, this research aims to investigate whether a difference in behavior among respondents exists based on their gender and age and, more precisely, the class year attended by respondents at the time of participating in the survey. Therefore, two additional hypotheses are established:

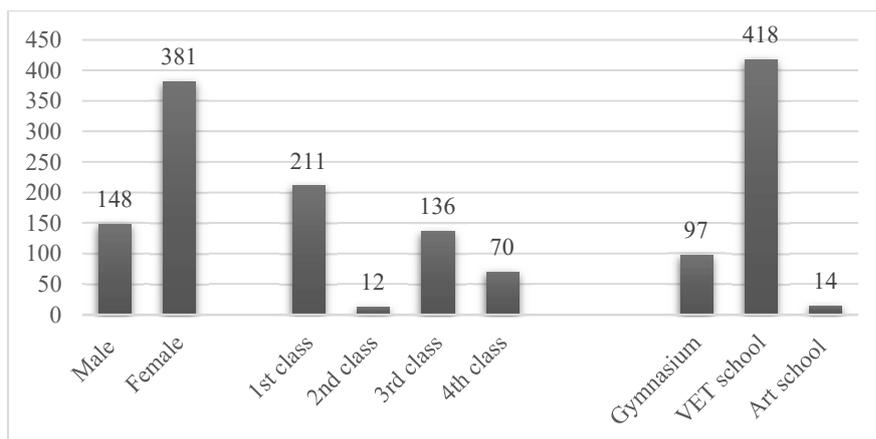
- H4** There is a statistical significance in the pro-environmental behavior of pupils based on their gender.
- H5** There is a statistical significance in the pro-environmental behavior of pupils based on class year they attended.

#### *Research sample*

Participating in the survey was a suitable sample of 529 pupils from secondary schools in the City of Zagreb. In all, 381 (72%) were females, and 148 (28%) were males. Based on the class year in which pupils were enrolled in the 2020/2021 school year, the sample included 211 (40%) respondents from Year 9, 112 (21%) from Year 10, 136 (26%) from Year 11, and 70 (13%) respondents from Year 12. Based on the type of school attended, 97 (18%) of respondents attended a grammar school, 418 (79%) attended a vocational school and 14 (3%) came from arts schools. Graph 1 shows the sample depicting its specifics.

#### **Graph 1**

*Sample of respondents based on gender, class year and type of secondary school (N)*



### Survey procedures and instruments

The research utilized a survey questionnaire devised using instruments from other authors (Bao, 2011; Dumbović, 2020; Licy et al., 2013; Ključević, 2017; McLaughlin, 2015; Olsson, 2018; Mrema, 2008; Sustainable Schools, 2012). The questionnaire comprises five sections. The first section poses questions relating to the sociodemographic features of the respondents (gender, class year and type of secondary school). The second section investigates how familiar respondents are with the fundamental environmental concepts. The respondents on the 5-point Likert scale (*strongly disagree, disagree, neither agree nor disagree, agree, strongly agree*) evaluated their familiarity with seven concepts relating to environmental protection: climate change, renewable energy sources, sustainable development, biological diversity, sustainable waste management, global warming, and finally water, soil and air pollution. This section of the survey poses an additional question relating to the respondent's familiarity with the UN Sustainable Development Goals. The pupils were able to select one of three multiple-choice answers (*I am, I am not, I don't know/I'm not sure*) to the question "Are you familiar with the UN global sustainable development goals?"

In the third section, respondents evaluated to what extent they agree with the six assertions relating to the protection and preservation of the environment using a 5-point Likert scale (*strongly disagree, disagree, neither agree nor disagree, agree, strongly agree*). In the fifth section of the survey, questions were posed on pupil behavior regarding the protection and preservation of the environment on a 4-point Likert scale (*never, sometimes, often and always*). In this section, of the survey, the respondents were asked the question as to whether they recycle sufficiently. Based on the three offered answers, if they replied negatively, they were then asked a subquestion as to what would motivate them to recycle more, and they could designate some of the offered responses.

In the final section of the survey, pupil opinions and attitudes were surveyed relating to ecological activities at the school they attended. The first question referred to an assessment by the pupil as to the extent to which they deemed important that their school was ecologically aware. The second question was posed to survey their opinion as to what extent does their school care about protecting and preserving the environment, with three possible answers offered: *none at all, a little, a moderate amount, a lot, a great deal*. The third question in this section of the survey read, "If you were the principal of your school, which of the below activities would you introduce to make your school more ecologically aware?" Pupils were able to select among the nine offered answers, such as *It would increase the amount of renewable energy used at the school and schoolyard; I would take more care separating waste and composting food from school canteens; I would organize environmental sustainability days at school; and the like*. The final question gave pupils the opportunity to answer the question of whether their school was involved in environmental protection in the local community (such as collaborating with "green" associations, projects in the local community and the like). The possible answers were *yes, no, and I don't know*. After devising the survey questionnaire, adapted to an online format and the link for accessing the online survey questionnaire along with a brief presentation, the explanation of the intention and invitation to participate in the research was sent to official e-mail addresses at all secondary schools in the City of Zagreb. Filling the online survey questionnaire began on 2 June 2021, and the respondents were able to access the questionnaire until 30 June 2021. After collecting the surveys, the data were presented in

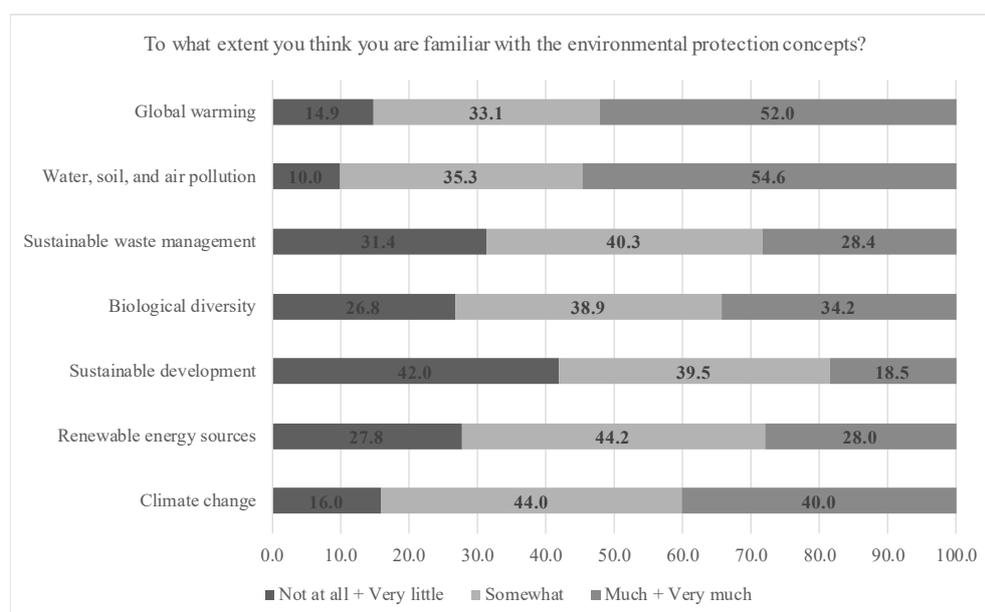
graphical and tabular form and statistically analyzed using the MS Office package (Analysis ToolPak).

## RESULTS AND DISCUSSION

In the first section of the questionnaire, the extent to which pupils are familiar with fundamental concepts relating to the protection and preservation of the environment was surveyed. The obtained results were subjected to descriptive analysis. The analysis relied on the 5-point Likert scale and was linked to three categories: *none at all + a little*, *a moderate amount*, and *a lot + a great deal*. The results in Graph 2 show that pupils, in general, have an average familiarity with the provided concepts. Most pupils (55%) are familiar with the concept of water, soil and air pollution and the concept of global warming (52%). Somewhat fewer are familiar with the concepts of climate change (40%) and biological diversity (34%) and still less familiar with the concepts of sustainable waste management (28%) and renewable energy sources (28%).

**Graph 2**

*The pupil's familiarity with environmental protection concepts (%)*



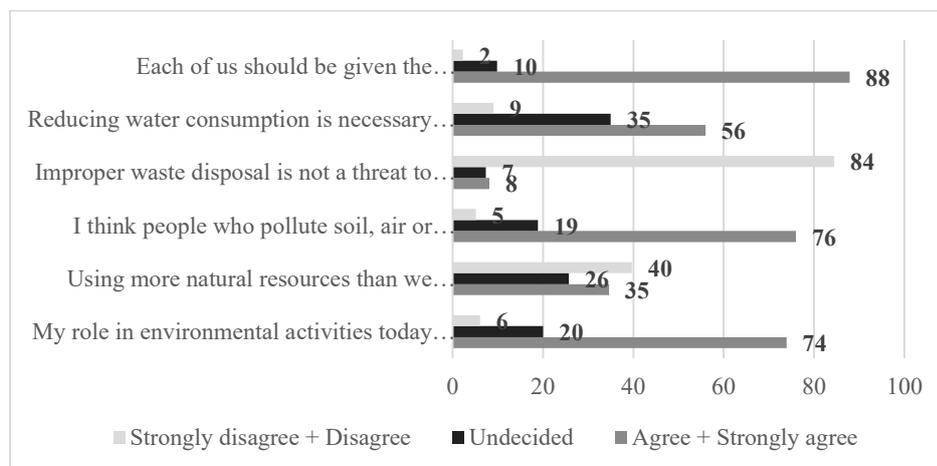
Interestingly, pupils are least familiar with the concept of sustainable development. Namely, only 19% of pupils were familiar with the concept, whereas 42% stated they were not, and 39% could not make an evaluation. This is especially concerning given that all global (and national) activities in environmental protection are based on the concept of sustainable development. Although the interdisciplinary subject *Sustainable Development for Primary and Secondary Schools* was introduced only three years ago in the Croatian education system, this result may indicate its insufficient presence in classes. This is supported by the results from the additional question used to evaluate students' familiarity with the UN's Global Sustainable Development Goals. Namely, only 93 (18%) pupils stated that they were familiar with the goals. In comparison, 201 (38%) stated the opposite, and 235 (44%) did not know or were not sure, which is a high percentage given the importance of global sustainable development goals not only in terms of ecology but also economic and social aspects of life for today's and future generations. However, Zagreb secondary school pupils do not deviate on this topic from pupils in other countries. Namely, research conducted in 2021 shows that other secondary school pupils have a relatively low level of familiarity with the concepts and goals of sustainable development (Yuan et al., 2021). A somewhat better situation can be found in the area of higher education. International research on students' familiarity with the Global Sustainable

Development Goals conducted in 2020 shows that students are, to a large extent, familiar with the mentioned goals, where Asian students lead (75%), followed by African students (65%) and only then European students (44%) (SOS International, 2021).

Familiarity with concepts concerning the environment and its protection is the basic component to raise the level of awareness and responsible behavior toward the environment (Bradley et al., 1999; Erhabora & Dona, 2016). Although the results indicate that students, to a certain extent, are familiar with environmental protection concepts, whereby hypothesis H1 can be confirmed, it is apparent that there is much room for improvement, especially in knowing the concept of sustainable development. However, possessing only knowledge is not sufficient to actively solve ecological issues. An important segment of human care toward the environment is also one's attitude toward the environment. Bradley et al. (1999) used their research to show that the relationship between knowledge and attitudes has statistical significance, which indicates that more knowledge about the environment may also improve attitudes concerning it. That the attitudes of young people toward the environment are especially important is testified to by the fact that in the end, young people will be the ones to experience the consequences of ecological problems and have to provide solutions for problems stemming from today's actions. Therefore, one of the focuses of this research is to survey pupils' attitudes concerning the protection and preservation of the environment. Hence, pupils were asked a question from the questionnaire to what extent they agreed with the six offered assertions relating to environmental protection. This question required reducing the 5-point scale to 3 categories to facilitate interpretation of the results. In one of the categories, the responses *strongly disagree* + *disagree* were combined into another, *agree* + *strongly agree*.

### Graph 3

*Pupil attitudes on assertions relating to the protection and preservation of the environment (%)*

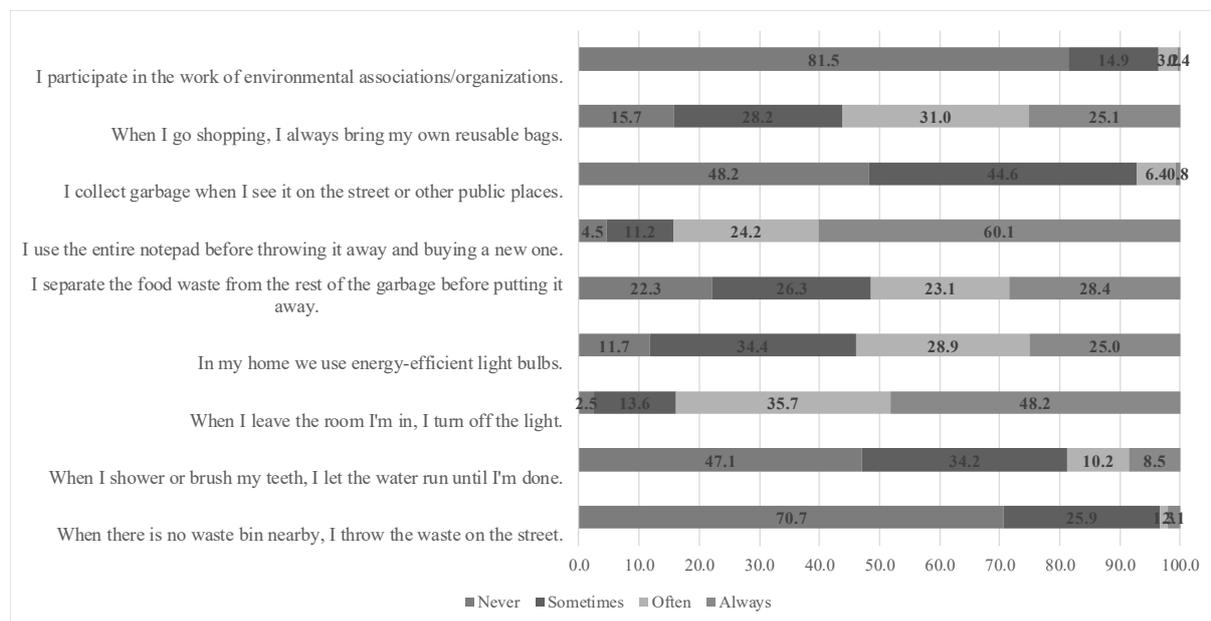


Data from Graph 3 show that pupils expressed positive attitudes relating to protecting and preserving the environment. Most pupils agree with the assertion that, in formal education, all should get the opportunity to acquire knowledge, values and skills in environmental protection (88%) and that improper waste disposal is a threat to the environment (84%). Most think that those who pollute the soil, air or water should pay for damages they inflict on the environment (76%). Additionally, a large majority consider that their role in ecological activities can save the environment for future generations (74%). They are somewhat less sure concerning the assertion that reducing water consumption is essential for sustainable development. Namely, 56% stated affirmatively, but 35% were unsure about the assertion. The reason for this may be, as already recognized in this research, insufficient knowledge of the concept of sustainable development. They are also unsure as to whether exploiting more natural resources than what we need jeopardizes human health and their chances for well-being in the future. Namely, an equal number of respondents agreed and disagreed with the mentioned assertion. Even though pupils remained reserved in two statements, the responses of most of them reflect pro-environmental attitudes; hence, hypothesis H2 can be affirmed.

In addition to knowledge and attitudes, an essential prerequisite for developing ecological awareness is behavior. Research has shown that pro-environmental attitudes are cited as a significant predictor of ecological behavior, i.e., respondents who express positive attitudes toward the environment are also prepared to become ecologically engaged (Eilam & Trop, 2012; Meinhold & Markus, 2005; Pennington, 1997; as cited in Vargek, 2019). Consequently, the level of pro-environmental behavior of pupils was surveyed. Graph 4 indicates that most pupils (60%) always use the entire notepad prior to discarding it and buying a new one, whereas 48% never throw waste onto the street when there is no garbage bin nearby, and 26% do it sometimes. However, half of the respondents never picked up garbage if noticing it on the street or in other public places.

**Graph 4**

*Behavior of pupils relating to the protection and preservation of the environment (%)*



Furthermore, even though half of the pupils stated that they never leave the water to run until finishing showering or washing their teeth, interestingly, only 34% do that sometimes. In all, 28% pointed out that they always separate waste from food and the remaining garbage prior to disposing of it, and a somewhat smaller percentage (23%) stated that they never do it. When referring to the use of energy-efficient light bulbs in their own home, most of the pupils selected the answer *sometimes* (34%). The results indicate that pupils, somewhat less seldom, use their own reusable bags when going to the shops. Finally, a concerning fact is that most pupils (82%) have never participated in the work of ecological associations/organizations.

In the section of the questionnaire that asks about pupil behavior, the question was posed relating to their assessment of whether they recycle sufficiently. In all, half of the pupils stated that they recycled sufficiently, one fifth was not sure or did not want to answer, and 29% stated that they did not recycle sufficiently. Pupils who replied negatively to the previous question were asked an additional question to determine what would motivate them to recycle more often. The pupils were proposed a number of responses, of which they could choose at least two. Most would find additional motivation if there were more garbage bins around schools or the building/house in which they live (61%), followed by those who are familiar with what goes on with waste after it is separated into separate bins (48%), and then if their schools recycled more (36%), and if they knew a little bit more about how and what can be recycled (34%). They said they find the least motivation if more of their friends would recycle (22%) and if there existed detailed instructions on garbage bins (21%).

Considering all that has been said, hypothesis H3, which presupposes that pupils expressed pro-environmental behavior, is partially affirmed.

### DIFFERENCES IN BEHAVIOUR BASED ON GENDER AND CLASS YEAR

To verify whether there is a statistical significance for the differences in the pro-environmental behavior of pupils based on their gender, a t test ( $p < 0.05$ ) was conducted, where the descriptive parameters and results are given in Table 1. The statistical significance for the difference in behavior among pupils based on the pupil's gender is affirmed for five of the nine assertions.

**Table 1**

*Differences in the pro-environmental behavior of pupils based on gender*

	MALE				FEMALE				p value
	N	M	SD	M <sub>o</sub>	N	M	SD	M <sub>o</sub>	
When there is no waste bin nearby, I throw the waste on the street.	148	1.48	0.71	1	381	1.30	0.57	1	0.002*
When I shower or brush my teeth, I let the water run until I'm done.	148	1.94	1.04	1	381	1.75	0.89	1	0.035*
When I leave the room I'm in, I turn off the light.	148	3.22	0.86	4	381	3.33	0.76	4	0.146
In my home we use energy-efficient light bulbs.	148	2.57	0.96	3	381	2.71	0.98	2	0.129
I separate the food waste from the rest of the garbage before putting it away.	148	2.37	1.15	2	381	2.65	1.10	4	0.009*
I use the entire notepad before throwing it away and buying a new one.	148	3.16	1.00	4	381	3.49	0.78	4	0.00004*
I collect garbage when I see it on the street or other public places.	148	1.59	0.64	1	381	1.60	0.65	1	0.833
When I go shopping, I always bring my own reusable bags.	148	2.42	1.02	2	381	2.75	1.01	3	0.0008*
I participate in the work of environmental associations/organizations.	148	1.24	0.48	1	381	1.22	0.53	1	0.609

$p < 0,05$

There is a statistical significance for male pupils to be more prone to discard waste onto streets and let water flow until finishing showering and washing their teeth. On the other hand, female pupils are more prone to separate biowaste from other garbage than male pupils, use their entire notepad before buying another one and use their reusable bags when buying at the shops. Given that the t test confirmed a statistically significant difference between male and female pupils for a number of established hypotheses, hypothesis H4 can be partially affirmed.

These results conform to similar research, which has shown that women, in comparison to men, are more pro-environmentally orientated, i.e., demonstrate a higher level of ecocentrism, which includes care for nature and all living beings, than is the case with men (Hassan et al., 2010; Zelezny et al., 2000; Vicente-Molina et al., 2018). Based on the theory of socialization, such behavior stems from gender expectations and a cultural tradition in which women have learnt to become more compassionate, cooperative and helpful in caring roles. In contrast, men are socialized to be more independent and competitive (Zelezny et al., 2000). Regarding ecological behavior, Vivente-Molina et al. (2018) confirmed that women are more active in the so-called private domain of pro-environmental actions, such as purchasing organic products, separating recycled material or using vehicles less

frequently, whereas men are more dominant in activities within the so-called public sphere, such as membership in ecological groups, signing petitions and the like. Therefore, future research could focus on a more detailed investigation of the gender perspective in the context of environmental protection and preservation.

In addition to the differences between pupils based on gender, this research examined whether there is a difference between pupils based on age, i.e., attended class year at the time of participating in the research. Classes were reduced to two categories to facilitate data analysis. Hence, respondents from Year 9 and Year 10 were placed into the “lower years” category, while respondents from Year 11 and Year 12 fell into the “higher years” category. Table 2 shows the descriptive data and statistical significance obtained from the t test ( $p < 0.05$ ).

**Table 2**

*Differences in pro-environmental behavior among students based on the class year*

	LOWER YEARS				HIGHER YEARS				p value
	N	M	SD	M <sub>o</sub>	N	M	SD	M <sub>o</sub>	
When there is no waste bin nearby, I throw the waste on the street.	323	1.32	0.58	1	206	1.39	0,67	1	0.227
When I shower or brush my teeth, I let the water run until I'm done.	323	1.71	0.89	1	206	1.95	0,99	1	0.004*
When I leave the room I'm in, I turn off the light.	323	3.21	0.80	4	206	3.43	0,76	4	0.002*
In my home we use energy-efficient light bulbs.	323	2.62	0.98	2	206	2.75	0,96	2	0.151
I separate the food waste from the rest of the garbage before putting it away.	323	2.54	1.12	4	206	2.62	1,12	4	0.445
I use the entire notepad before throwing it away and buying a new one.	323	3.43	0.82	4	206	3.34	0,91	4	0.246
I collect garbage when I see it on the street or other public places.	323	1.61	0.67	1	206	1.58	0,61	1	0.575
When I go shopping, I always bring my own reusable bags.	323	2.65	1.02	2	206	2.67	1,02	3	0.870
I participate in the work of environmental associations/organizations.	323	1.22	0.47	1	206	1.24	0,57	1	0.643

$p < 0,05$

A statistically significant difference was identified for two of the nine assertions. There is a significant difference for pupils from higher years showing a greater inclination to let water flow while showering or washing their teeth compared to lower years. On the other hand, pupils from higher years are more inclined to switch the light off when leaving a room than pupils from lower years. Given that no statistically significant difference was identified in the remaining seven assertions, hypothesis H5 can be accepted only partially. In this context, it should be noted that the results of the research conducted by Wang et al. (2021) confirm that there is a connection between age and pro-environmental behavior, suggesting that pro-environmental behavior increases with age. The underlying reason may be an increased awareness of harmful effects to the environment and personal health. However, other research indicates that the effect of age differences is less in terms of ecological behavior (Pillemer et al., 2011; Rosenbloom, 2001; as cited in Wang et al., 2021). The

results from this research may be useful as a starting point and encouragement for further research in this specific field.

## CONCLUSION

The development of technology, science and the economy has significantly advanced the quality of life but, at the same time, contributed to greater exploitation of natural resources, resulting in a significant number of ecological problems. In the last few decades, there has been an increase in interest in the protection and preservation of the environment at the international, European and national levels. At that time, several significant agreements were reached that were dedicated to environmental protection issues, which led to a rise in society's awareness of the impact on the environment and human health.

To examine the extent to which secondary school pupils in the City of Zagreb are ecologically aware, a survey on a sample of 529 pupils was conducted. The survey results show that pupils are generally familiar with the concepts of environmental protection; however, a concern is that a large number are not familiar with the term and concept of sustainable development, which is considered one of the key elements in formulating and implementing development policies in the world. Therefore, it is desirable to survey whether this involves insecurity on behalf of the pupil's own knowledge or perhaps the pupil is not sufficiently attentive to topics relating to sustainable development and environmental protection during the teaching process. This result may also be an invitation to afford more attention within formal education to these goals, as well as numerous other topics in the protection and preservation of the environment. Additionally, it is desirable to examine the readiness and competence of teachers in presenting these and similar topics within the teaching process.

In terms of the attitudes held by Zagreb secondary school pupils in the protection and preservation of the environment, the indications are that pupils express pro-environmental behavior. A large majority stated that their role in ecological activities can save the environment for future generations, but at the same time, a very small number participated in the work of ecological associations. Therefore, examining whether the cause of this is their passivity or lack of such associations, programs and activities in their local communities in which they could get involved would be beneficial. Additionally, this research has endeavored to examine whether the difference between pupils in pro-environmental behavior is based on gender and the class year they attend. The results show a statistically significant difference between several assertions. For instance, male pupils are more likely to discard waste on the streets and let the water run when showering or washing their teeth as opposed to female pupils. Female pupils are more likely to separate biowaste from garbage than male pupils and use up an entire notebook and their own reusable bags when shopping. On the other hand, there is a statistical significance for pupils from higher years who are more likely to let the water run while showering or washing their teeth in contrast to lower years. Pupils from higher years are more likely to switch off the light when leaving a room than pupils from lower years.

Despite certain limitations of the conducted research, its usefulness is reflected in the fact that it provides some insight into the level of environmental awareness of high school students and can be used for further reflection on the need to adapt educational content within formal education to empower young people to become as active as possible in protecting and preserving the environment. After all, the world rests on the young

## REFERENCES

- Abbas, M. Y., & Singh, R. (2014). A Survey of Environmental Awareness, Attitude, and Participation amongst University Students: A Case Study. *International Journal of Science and Research*, 3(5), 1755–1760.
- Afrić, K. (2002). Ekološka svijest - pretpostavka rješavanja ekoloških problema. *Ekonomski pregled*, 53(5–6), 578–594.
- Aleixo, A. M., Leal, S., & Azeiteiro, U. M. (2021). Higher education students' perceptions of sustainable development in Portugal. *Journal of Cleaner Production*, 327. <https://doi.org/10.1016/j.jclepro.2021.129429>
- Anđić, D. (2007). Paradigmatski aspekti problematike okoliša i odgoj za okoliš i održivi razvoj. *Metodički ogledi*, 14(2), 9–23.
- Bao, R. (2011). *Waste and recycling attitudes and behavior of students in Turku* [master thesis, Turku University, Finland]. [https://www.lsjh.fi/wp-content/uploads/Rina-Bao\\_masters-thesis\\_print.pdf](https://www.lsjh.fi/wp-content/uploads/Rina-Bao_masters-thesis_print.pdf)
- Bernska konvencija o očuvanju europskih divljih životinja i prirodnih staništa* (1979). <https://eur-lex.europa.eu/legal-content/HR/TXT/?uri=LEGISSUM:128050>
- Bolscho, D. (1996). Environmental education and environmental awareness. *Socijalna ekologija: Journal for environmental thought and sociological research*, 5(3), 311–321.
- Bradley, J. C., Waliczek, T. M., & Zajicek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education*, 30(3), 17–21. <https://doi.org/10.1080/00958969909601873>
- Cifrić, I. (2006). Odnos prema životu. Kontekst biocentrične orijentacije. *Socijalna ekologija*, 15(1-2), 43–79.
- Colby, M. E. (1991). Environmental management in development: the evolution of paradigms. *Ecological Economics*, 3(3), 193–213. [https://doi.org/10.1016/0921-8009\(91\)90032-A](https://doi.org/10.1016/0921-8009(91)90032-A)
- Communication from the Commission to the European Parliament, the European Council, The Council, the European Economic and Social Committee and the Committee of the Regions (2020). *European green deal*. [https://ec.europa.eu/info/sites/default/files/european-green-deal-communication\\_en.pdf](https://ec.europa.eu/info/sites/default/files/european-green-deal-communication_en.pdf)
- Čuvalo, I. (2021). *Onečišćenje zraka i okoliša* [diplomski rad, Veleučilište u Karlovcu]. Repozitorij Veleučilišta u Karlovcu. <https://repozitorij.vuka.hr/en/islandora/object/vuka%3A1849>
- Dumbović, D. (2020). *Ekološka osviještenost mladih potrošača u Republici Hrvatskoj* [master thesis, University of Zagreb]. Repozitorij radova Ekonomskog fakulteta Zagreb. <https://urn.nsk.hr/urn:nbn:hr:148:540298>
- Erhabora, N., & Dona, J. (2016). Impact of environmental education on the knowledge and attitude of students towards the environment. *International journal of environmental and science education*, 11(12), 5367–5375. <https://doi.org/10.25073/0866-773x/68>
- European Environment Agency (2020). *Air quality in Europe - 2020 report*. <https://www.eea.europa.eu/publications/airquality-in-europe-2020-report>
- FAO and IWMI (2017). *Water pollution from agriculture: a global review*. <http://www.fao.org/3/a-i7754e.pdf>
- Gambro, J. S., & Switzky, H. N. (1996). A national survey of high school students' environmental knowledge. *The Journal of Environmental Education*, 27(3), 28–33. <https://doi.org/10.1080/00958964.1996.9941464>
- Gudmanian, A., Drotianko, L., Shostak, O., Kleshnia, H., & Ordenov, S. (2020). Transformation of ecological consciousness in the process of solving global ecological problems. *E3S Web of Conferences*, 175. <https://doi.org/10.1051/e3sconf/202017514017>
- Hassan, A., Noordin, T., & Sulaiman, S. (2010). The status on the level of environmental awareness in the concept of sustainable development amongst secondary school students. *Procedia - Social and Behavioral Sciences*, 2(2), 1276–1280. <https://doi.org/10.1016/j.sbspro.2010.03.187>
- Helsinška konvencija o sprječavanju onečišćenja u međunarodnim vodotocima i jezerima (1992). <https://eur-lex.europa.eu/legal-content/HR/TXT/?uri=celex%3A21995A0805%2801%29>
- Helsinška konvencija o zaštiti Baltičkog mora* (1974). <https://eur-lex.europa.eu/summary/HR/128089>

- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, E., Mayall, E., Wray, B., Mellor, C., & Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The LANCET Planetary Health*, 5(12), 863–873. [https://doi.org/10.1016/S2542-5196\(21\)00278-3](https://doi.org/10.1016/S2542-5196(21)00278-3)
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: mapping different approaches. *Sustainable development*, 13(1), 38–52. <https://doi.org/10.1002/sd.244>
- Hrvatski sabor (2021). *Nacionalna razvojna strategija Republike Hrvatske do 2030*. [https://narodne-novine.nn.hr/clanci/sluzbeni/2021\\_02\\_13\\_230.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2021_02_13_230.html)
- Husić, J. (2021). *Utjecaj industrijalizacije na okoliš i čovjekovo zdravlje* [bachelor thesis, Veleučilište u Karlovcu]. Repozitorij Veleučilišta u Karlovcu. <https://repozitorij.vuka.hr/islandora/object/vuka:1782>
- Jukić, R. (2011). Ekološko pitanje kao odgojno-obrazovna potreba. *Socijalna ekologija: časopis za ekološku misao i sociologijska istraživanja okoline*, 20(3), 267–286.
- Kerr, R. A. (2007). Global warming is changing the world. *Science*, 316(5822), 188–190. <https://doi.org/10.1126/science.316.5822.188>
- Ključević, D. (2017). *Ekološka osviještenost učenika mlađe školske dobi* [master thesis, Josip Juraj Strossmayer Univeristy of Osijek]. Repozitorij Fakulteta za odgojne i obrazovne znanosti Osijek. <https://repozitorij.foozos.hr/islandora/object/foozos:994>
- Konvencija o zaštiti Alpa (1995). [http://publications.europa.eu/resource/cellar/35db8f84-f6c9-4cd4-94b5-0fc702cdd2f3.0012.02/DOC\\_1](http://publications.europa.eu/resource/cellar/35db8f84-f6c9-4cd4-94b5-0fc702cdd2f3.0012.02/DOC_1)
- Konvencija o zaštiti Sredozemnog mora od onečišćenja (1976). <https://eur-lex.europa.eu/legal-content/HR/TXT/?uri=celex%3A21976A0216%2801%29>
- Krznar, T. (2008). Čovjek i okoliš u socijalnom kontekstu: Prilog socijalno-ekološkom istraživanju. *Ekonomika i ekohistorija: časopis za gospodarsku povijest i povijest okoliša*, 4(1), 134–150.
- Laurance, W. F. (1999). Reflections on the tropical deforestation crisis. *Biological Conservation*, 91(2-3), 109–117. [https://doi.org/10.1016/s0006-3207\(99\)00088-9](https://doi.org/10.1016/s0006-3207(99)00088-9)
- Li, Y. (2018). Study of the effect of environmental education on environmental awareness and environmental attitude based on environmental protection law of the People's Republic of China. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(6), 2277–2285. <https://doi.org/10.29333/ejmste/86214>
- Licy, C. D., Vivek, R., Saritha, K., Anies, T. K., & Josphina, C. T. (2013). Awareness, attitude and practice of school students towards household waste management. *Journal of environment*, 2(6), 147–150.
- McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. (2013). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*, 4(5), 1–20. <https://doi.org/10.1890/ES13-00075.1>
- McLaughlin, J. (2015). *2015 Student Sustainability Survey*. Brookings: South Dakota State University. <https://www.scribd.com/document/453551027/2015Student-Sustainability-Survey->
- Ministarstvo znanosti i obrazovanja (2019). Odluka o donošenju kurikuluma za međupredmetnu temu Održivi razvoj za osnovne i srednje škole u Republici Hrvatskoj. [https://narodne-novine.nn.hr/clanci/sluzbeni/2019\\_01\\_7\\_152.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_152.html)
- Mishra, R. K., Mohammad, N., & Roychoudhury, N. (2016). Soil pollution: Causes, effects and control. *Van Sangyan*, 3(1), 1–15.
- Mrema, K. (2008). *An assessment of students' environmental attitudes and behaviors and the effectiveness of their school recycling programs* [diplomski rad, Sveučilište Dalhause, Kanada]. <https://dalspace.library.dal.ca/handle/10222/76596>
- Oldfield, F. (1983). Man's impact on the environment: some recent perspectives. *Geography*, 68(3), 245–256. <https://www.jstor.org/stable/40570695>
- Olsson, D. (2018). *Student Sustainability Consciousness: Investigating Effects of Education for Sustainable Development in Sweden and Beyond* [doktorska disertacija, Karlstad, Njemačka]. <https://www.diva-portal.org/smash/get/diva2:1257928/FULLTEXT02.pdf>
- Previšić, V. (2008). Globalne dimenzije održiva razvoja u nacionalnom školskom kurikulumu. U Uzelac, V. i Vujičić, L. (ur.), *Cjeloživotno učenje za održivi razvoj* (pp. 55–66). Učiteljski fakultet u Rijeci.

- Ryke, P. A. J. (1987). Man's impact on the environment. *Koers*, 52(1–4), 440–480. <https://doi.org/10.4102/koers.v52i1-4.916>
- Scott, W., & Vare, P. (2020). *Learning, Environment and Sustainable Development: A History of Ideas*. Routledge.
- Seymour, V. (2016). The human-nature relationship and its impact on health: A critical review. *Frontiers in Public Health*, 4, 1–12. <https://doi.org/10.3389/fpubh.2016.00260>
- Singh, R. M., & Gupta, A. (2017). Water Pollution: Sources, Effects and Control. [https://www.researchgate.net/profile/Asha-Gupta-6/publication/321289637\\_WATER\\_POLLUTION-SOURCEEFFECTS\\_AND\\_CONTROL/links/5a194005aca272df080a9dd3/WATER-POLLUTION-SOURCES-EFFECTS-AND-CONTROL.pdf](https://www.researchgate.net/profile/Asha-Gupta-6/publication/321289637_WATER_POLLUTION-SOURCEEFFECTS_AND_CONTROL/links/5a194005aca272df080a9dd3/WATER-POLLUTION-SOURCES-EFFECTS-AND-CONTROL.pdf)
- Smith, M. A., & Kingston, S. (2021). Demographic, Attitudinal, and Social Factors That Predict Pro-Environmental Behavior. *Sustainability and Climate Change*, 14(1), 47–54. <https://doi.org/10.1089/scc.2020.0063>
- Sustainable Schools (2012). *Sustainability Assessment Questionnaire for K-12 Schools*. <http://sustainschools.org/wp-content/uploads/2013/04/SAQforK12.pdf>
- UNESCO (2014). *Shaping the future we want. UN Decade of Education for Sustainable Development (2005-2014)*. <https://unesdoc.unesco.org/ark:/48223/pf0000230302>
- UNFCCC (2021). *About the Secretariat*. <https://unfccc.int/about-us/about-the-secretariat>
- United Nations (2015). *The Millennium Development Goals Report 2015*. [https://www.un.org/millenniumgoals/2015\\_MDG\\_Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf)
- United Nations (2019). *Global Sustainable Development Report 2019*. [https://sustainabledevelopment.un.org/content/documents/24797GSDR\\_report\\_2019.pdf](https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf)
- Vargek, D. (2019). *Pro-ekološki stavovi i osobine ličnosti budućih učitelja* [diplomski rad, Sveučilište u Rijeci]. Repozitorij Učiteljskog fakulteta u Rijeci. <https://zir.nsk.hr/islandora/object/ufri%3A518/datastream/PDF/view>
- Vicente-Molina, M. A., Fernández-Sainz, A., & Izagirre-Olaizola, J. (2018). Does gender make a difference in pro-environmental behavior? The case of the Basque Country University students. *Journal of Cleaner Production*, 176, 89–98. <https://doi.org/10.1016/j.jclepro.2017.12.079>
- Vickers, I. (1999). Cleaner production and organizational learning. *Technology Analysis & Strategic Management*, 11(1), 75–94. <https://doi.org/10.1080/095373299107591>
- Vukelić, N., Rončević, N., & Vinković, A. (2018). *Jesu li budućni nastavnici spremni za integraciju obrazovanja za održivi razvoj u nastavu?* [https://www.researchgate.net/profile/Nena-Vukelic/publication/337010122\\_Jesu\\_li\\_buduci\\_nastavnici\\_spremni\\_za\\_integraciju\\_OOR\\_u\\_nastavu/links/5dc032274585151435e57f77/Jesu-li-buduci-nastavnici-spremni-za-integraciju-OOR-u-nastavu.pdf?origin=publication\\_detail](https://www.researchgate.net/profile/Nena-Vukelic/publication/337010122_Jesu_li_buduci_nastavnici_spremni_za_integraciju_OOR_u_nastavu/links/5dc032274585151435e57f77/Jesu-li-buduci-nastavnici-spremni-za-integraciju-OOR-u-nastavu.pdf?origin=publication_detail)
- Wang, Y., Cao, H., Yuan, Y., & Zhang, R. (2020). Empowerment through emotional connection and capacity building: Public participation through environmental nongovernmental organizations. *Environmental Impact Assessment Review*, 80. <https://doi.org/10.1016/j.eiar.2019.106319>
- WWF (2020). *Living Planet Report 2020 - Bending the curve of biodiversity loss*. <https://www.zsl.org/sites/default/files/LPR%202020%20Full%20report.pdf>
- Xu, Y., Li, W., & Chi, S. (2021). Altruism, Environmental Concerns, and Proenvironmental Behaviors of Urban Residents: A Case Study in a Typical Chinese City *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.643759>
- Yuan, X., Yu, L., & Wu, H. (2021). Awareness of Sustainable Development Goals among Students from a Chinese Senior High School. *Educational Sciences*, 11(458), 1–25. <https://doi.org/10.3390/educsci11090458>
- Zelezny, L. C., Chua, P. P., & Aldrich, C. (2000). Elaborating on gender differences in environmentalism. *Journal of Social Issues*, 56(3), 443–457. <https://doi.org/10.1111/0022-4537.00177>

Zwolińska, K., Lorenc, S., & Pomykała, R (2022). Sustainable Development in Education from Students' Perspective - Implementation of Sustainable Development in Curricula. *Sustainability*, 14(6), 1–27. <https://doi.org/10.3390/su14063398>