EDUCATIONAL PATHWAYS TOWARDS SUSTAINABILITY: STUDENT LITERACY IN ENVIRONMENTAL STUDIES

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Abstract: *In this paper, the authors investigate the environmental literacy among students at the University of Belgrade - Faculty of Organizational Sciences, Serbia. The reason for this research lies in the fact that the way to a more responsible and sustainable world of today and tomorrow is based on environmentally literate and educated experts and decision-makers who could face the growing environmental problems of nowadays. This research emphasizes the need to include extensive environmental education within Bachelor of Science programs with the goal of increasing students' understanding, accountability, and active involvement in environmental sustainability. The findings enriched the discussion on environmental education and education for sustainable development by providing valuable information for educators and policymakers looking to improve the status of environmental literacy at higher education institutions.*

Keywords*: Environmental literacy, environmental education, sustainable development, higher education*

1. INTRODUCTION

Thanks to the actions of the human species, the natural balance of Earth is in jeopardy today more than ever (Petrović, 2016). Also, “humanity has become a dominant force in shaping the face of Earth” (Elhacham et al., 2020; Haff, 2014; Krausmann et al., 2009; Matthews et al., 2000; Smil, 2012; Stephens et al., 2019; Zalasiewicz et al., 2019). For this reason, scholars like Crutzen and Stoermer (2000), Steffen et al. (2007), Scholz (2011), and Huang and Xiao (2017) have named the current epoch the Anthropocene (Ha et al., 2021). According to the UN global assessment study, the destruction of nature has accelerated over the past 10 million years, resulting in coral reefs flickering out under the oceans and rainforests drying into savannahs (Watts, 2021). According to the author Robinson (2024), among the most significant environmental issues of our day are “global warming from fossil fuels, poor governance, food waste, biodiversity loss, plastic pollution, deforestation, air pollution, melting ice caps and sea level rise, ocean acidification, agriculture, food and water insecurity, fast fashion and textile waste, overfishing, cobalt mining, and soil degradation”.

Having in mind that environmental education (EE) is one of the most efficient approaches to preparing young people for the world's ever-changing environmental issues (Borojevic et al., 2014; Radaković et al., 2017), the authors of the paper conducted research on the level of environmental literacy (EL) among undergraduate students at the University of Belgrade - Faculty of Organizational Sciences, Belgrade, Serbia. Why is EL so important? This is because establishing integrity in human-nature relationships is critical to the survival and growth of our civilization. As a result, we must learn about life-sustaining ecosystems and how they work, as well as about ecology and environment, which are the bases of EL. It is important to recognize that EL significantly contributes to the SD of global society (Ha et al., 2021).

The presented research in the paper included 265 students aged from 20 to 31 years old. Students were requested to respond to a 32-item online survey. All responses are provided voluntarily and in an anonymous manner. The responses were then tested for assessment using SPSS 26 software package.

The paper is structured into the following subsections. We present a theoretical framework concerning environmental literacy in Section 2. Methods and materials are detailed in Section 3. The survey results are presented and discussed in Section 4, while the conclusions are presented in Section 5.

2. ENVIRONMENTAL LITERACY

Etymologically, “literacy” comes from a word used in the eighteenth century to characterize basic reading and writing proficiency (Stibbe, 2009). These days, literacy includes studies in media, politics, and science (Maurer & Bogner, 2020).

Charles Roth (1968, 1992) was the first author to use the term “environmental literacy” for his studies about comprehending environmentally literate individuals. Since then, scholars have extensively examined and undergone significant changes to the definition of EL (McBride et al., 2013; Morrone et al., 2001; Simmons, 1995). The North American Association for Environmental Education (NAAEE) currently provides a widely accepted and frequently applied definition of EL: *EL encompasses skills, knowledge, and a motivation to address current environmental issues to prevent the emergence of future ones* (Education, 2022; Ha et al., 2021; North American Association for Environmental Education [NAAEE], 2004; Scholz, 2011). To the defining of EL should certainly be added a definition of the authors Maurer and Bogner (2020) who “viewed environmental literacy as a concept that integrated cognitive knowledge, environmental values, and ecological behavior” (Liu & Tobias, 2024).

What is certain is that:

- EL is crucial for preventing current and future environmental issues and promoting sustainability (Biswas, 2019).
- EL aims to promote sustainable behavior (Chepesiuk, 2007).
- Environmentally literate citizens are more likely to actively participate in addressing global environmental issues (Moseley, 2000).

When it comes to the components of EL, according to the authors Hollweg et al. (2011), there are four of them: “knowledge, affect, cognitive skills, and behavior”, or according to NAAEE (2011) they are: environmental knowledge, attitude, and environmental concern.

The EL aspects are given in Table 1.

Table 1: EL aspects*

Number	Dimension	Aspect
1	*Knowledge* (McBride et al., 2013; NAAEE, 2011)	*a) Environmental knowledge* *b) Socio political knowledge* c) *Knowledge of environmental issues*
2	*Attitude* (Ajzen, 2001; Dunlap et al., 2000; Erdogan & Marcinkowski, 2015)	*a) Environmental sensitivity* b) *Motivation and intention to act in participating actively towards environmental protection and improvement*
3	*Concern* (Hesham & Dajeh, 2011; McBride et al., 2013)	*a) Response towards environmental problem*

*Based on the works of Meilinda et al. (2017)

3. MATERIALS AND METHODS

For this research, the authors surveyed 256 students at the University of Belgrade – Faculty of Organizational Sciences. The research sample comprised out of 53.1% females and 46.9% males, the youngest participant was 20 years old, the oldest was 31, and the mean value of participant’s age was 22.18, while the biggest portion of participants were 21 (37.1%). Most of the students were in their third year of studies – 63.7%.

The collected data was analyzed using IBM SPSS Statistics 26 to gain insights into the patterns of responses. The primary analytical methods were descriptive statistics, including frequency distributions and crosstabulation. To determine the relationships between categorical variables, the chi-square test of independence was applied. A p value is used to indicate if the difference between two groups (or relationship between two variables) are statistically significant (where $p<0.05$ is considered statistically significant at the 95% confidence level). The significance and strength of associations between different variables within the dataset were assessed, thus providing a comprehensive understanding of the survey results.

The first four questions were demographic, the following three were about general environmental behavior, and after that the questions were divided into three sections – knowledge and awareness (13 questions), attitudes and feelings (seven questions), and environmental activism (five questions) – totaling in 32 questions.

4. RESULTS AND DISCUSSION

One of the initial questions in the questionnaire was the frequency at which students engage with environmental issues and news, whether it be on a daily, weekly, monthly, rare, or nonexistent basis. Most students (33.2%) said that they read daily, followed by those who do it weekly (30.5%), while just 18.8% of students rarely engage in environmental news. Unsurprisingly this younger generation reported that they mostly inform themselves on social media (41% and more females than males, $p<0.05$), followed by online portals (33.2%), while only a small portion of students watched documentaries (male students showed an inclination towards documentaries, $p<0.05$) and listened to podcasts – 13.3% and 9.4% respectively. For these youths, the social media they use the most is Instagram with 60.2% of respondents, then TikTok (18%), while only 7.8% use X (formerly known as Twitter) and 2.3% Facebook. When it came to traditional, and maybe "old school" ways of acquiring information, only 1.6% of students said that they read newspapers and textbooks (no females read textbooks) when wanting to inform themselves on environmental issues.

4.1. Knowledge and awareness

This section was comprised of 13 questions meant to evaluate the students' knowledge about environmental issues, ecology in general, and sustainable development. The first question was the students self-reporting and self-evaluating their environmental knowledge on a 1 to 5 Likert scale (1 – very poor, 5 – excellent). Most of the students self-evaluated themselves with a mark of 3 (55.9%), followed by a mark of 4 (27%). This suggests a recognition of some understanding but also an acknowledgment of gaps in their knowledge.

However, even though students felt that they deserved a mark of 3, a mark usually interpreted as "neither here nor there", 91% of students answered correctly to the question "What is climate change?". The data indicates a strong correlation between higher self-ratings and the belief that climate change is a result of significant long-term effects in the Earth's temperature (the correct answer). Conversely, less defined, or skeptical views on climate change correspond to lower self-ratings of students.

When asked to rate a series of sentences on their degree of agreement with them, using a Likert scale from 1 to 5 (1 - strongly disagree, 5 – strongly agree), the students gave the following answers:

- "Human actions are contributing to atmosphere and climate change". The statement received strong agreement (categories 4 – 26.2% and 5 – 61.3%) from most respondents. Among females, there was a particularly high level of agreement with 96 out of 131 respondents strongly agreeing. Most respondents (70.5%) who acknowledge all the mentioned implications of global warming strongly agree that human actions are contributing to it. This suggests a strong connection between their comprehension of human involvement and the wide-ranging effects of global warming. A large majority of respondents who understand climate change also strongly agree (69.4%) that human actions are contributing, showing a clear link in their understanding of human impact on climate.
- "Maintaining biodiversity means maintaining the number and variety of living organisms. This is necessary for sustainable development" - a significant proportion of responses fell into marks 4 (32.4%) and 5 (40.2%). There is a notable disparity in the number of "disagrees" (mark 2) between females and males. Specifically, no females disagreed, whereas 8 males did. Females exhibit a higher prevalence of strong agreement compared to males ($p<0.05$), indicating a little greater conviction regarding the significance of biodiversity among female respondents.

Other sentences that the students were meant to mark on a Likert scale and their mean values are the following:

- "Reducing the use of internal combustion engines helps reduce air pollution" – 3.86.
- "Using pesticides/fertilizers contributes to air pollution" – 3.92.
- "Human actions are contributing to atmosphere and climate change" – 4.54.
- "Maintaining biodiversity means maintaining the number and variety of living organisms. This is necessary for sustainable development" – 4.12%.

- “Sustainable development requires that individuals reflect on what it means to improve quality of life” – 4.18.
- “Good citizenship and good governance are necessary for sustainable development” – 4.34.
- “The conservation of drinking water is necessary for sustainable development” – 3.99.
- “Sustainable development requires a change in the use of renewable resources as much as possible” – 4.31.
- “Sustainable development requires access to quality education for everyone” – 4.22.

4.2. Attitudes and feelings

This section of the questionnaire included a series of 7 questions intended to assess students' attitudes and sentiments toward ecology and the environment to delve into their perceptions, convictions, and affective reactions towards environmental matters.

The students were first asked to rate the current state of the environment in their opinion on a Likert scale of 1 to 5 (1 – very poor, 5 – excellent). The results were a mean value of 2.38. Then they were asked to compare and evaluate the state of the environment 50 years ago on the same Likert scale and their expressed mean value was 3.18, showing that even though they personally feel that the state of the environment a long time before they were born was also poor, they at the same time believe it was better than today. Men were marginally more inclined than women to hold a moderately unfavorable perception of the previous status of the environment (mark 2). Women exhibited a greater prevalence in the neutral category (category 3) in comparison to men. A minority of respondents have a highly favorable perception of the previous environment (5 - excellent), with a higher proportion of males than females holding this perspective.

When asked whether they believed that the activities of an individual can have a positive/negative effect on the future of Planet Earth, most students answered yes – 85.9%, while 6.3% said no, and 7.8% said they were not sure. Interestingly enough, out of these students, the ones who said that they believed one person impacts leave an effect on the future of the Planet also said that they get informed about environmental issues through social media. This potentially means that since they are more exposed to seeing individual environmental activists on social media, they at the same time gain stronger beliefs that activism does matter. At the same time, many students who were unsure about the importance of individuals were podcast listeners.

One of the more important questions were on the feelings that the students felt regarding the environment and the Planet – the level of worry they feel about the environment impacting their future, their perceived pessimism or optimism about the future, and the most important environmental issues of today according to them.

When asked to rate how worried they were about the future of the environment impacting their personal future on a Likert scale of 1 to 5 (1 – not at all, 5 – extremely) the mean value of responses was 3.88 showing a moderate worry. At the same time women exhibit a greater level of concern, as seen by a larger percentage indicating they are “very worried” (51.9%) or “extremely worried” (34.35%). Males are also “not worried at all” or “slightly worried,” which was not reported by females.

Regarding the students’ pessimism or optimism about the future of the Planet on a Likert scale (1 – pessimistic, 5 –optimistic), the mean value of responses was 2.49 showing a very pessimistic outlook of the younger generation. Females generally exhibited a higher inclination towards pessimism compared to men, with a majority falling into the “very” and “somewhat pessimistic” categories (64.9% of females, $p<0.05$), while males exhibit a higher propensity for being categorized as “very optimistic”, in stark contrast to the relatively smaller percentage of females who are very optimistic (15.7% men versus 3% women, $p<0.05$).

According to students, air pollution is the number one pressing environmental issue of today (32%).

4.3. Activism

The final section of the questionnaire was meant to determine the scale of environmental activism among the students. Out of the surveyed students, 19.7% of them said that they feel that they are environmentally active, 60.9% said they are somewhat active, and 19.4% said they are not active. Out of these answers,

more females answered that they are active than males ($p<0.05$). As the level of their worry for the future of the Planet increases, there appears to be a trend toward higher activity levels.

When asked whether they recycle – 17.9% students said that they do, 70.7% said that they recycle sometimes, and 11.4% said that they do not recycle. When comparing the students who said that they believe that the activities of an individual matter when it comes to the future of the Planet with the students who recycle, the results showed a strong correlation between belief in power of an individual and proactive recycling habits.

Asking the students to report the environmental actions they participated in the last year and asking them to circle multiple answers (in this case total percentage goes over 100%) these were their answers: recycling – 76.3% of students, attending protests or rallies – 16.5% of students, donating to environmental organizations – 17% of students, and volunteering for environmental causes – 26.3%.

It is evident that students do not participate in environmental activities enough, but when posed with the question why, they said that it was because of lack of time (40.2%), lack of information (33.5%), skepticism about effectiveness (13.4%), and financial reasons (12.9%). When compared by genders ($p<0.05$), the primary reason mentioned by females for not engaging in environmental activism is a lack of time, but males commonly cite skepticism regarding effectiveness as their main reason.

When asked what types of support or resources would encourage them to participate more in environmental activism, the students said the following (multiple choice, percentage >100%): more information and education – 60.3%, organized events and activities – 50%, community support groups – 32.5%, incentives (tax reductions, subsidies) – 28.4%.

5. CONCLUSION

Unsurprisingly this younger generation reported that they mostly inform themselves on social media way more than they use traditional ways of acquiring knowledge. At the same time, almost no students used textbooks when wanting to find out more about environmental issues. This means that the future of higher education is somewhere between using social media and traditional ways of learning. For the educators to better appeal to younger generations they must accompany this shift to social media and the youth's way of thinking.

The students surveyed for this research gave themselves a mark of 3 when self-evaluating their environmental and sustainable development knowledge. Does this mean that the students' objective knowledge is somewhere in the middle – passable but not perfect? Does this mean they do not value themselves high enough subjectively? This is an issue that needs to be addressed in future research that will get to the bottom of this phenomenon. Positively, almost all students knew precisely what climate change was and what its consequences on the environment were.

The results indicate that students' minimal involvement in environmental activism is primarily a result of time constraints and restricted access to information. To enhance their level of participation, they express a need for additional educational opportunities and well-structured events that promote active involvement in environmental initiatives. Curiously, financial incentives are deemed unnecessary, perhaps because many students do not have substantial financial obligations. This suggests that the emphasis in promoting student involvement should be on providing educational assistance and well-organized programs rather than offering financial incentives.

As a conclusion, the authors would like to point out again that the students who used Instagram for their environmental news, believed more that the actions of individuals impact the state of the environment, and that environmental activism is making a difference. Is this because they watched videos of people working hands-on on environmental issues? This is a topic that opens many doors to educational opportunities as well as a means for inspiring the younger generation to make this world a better place, which, after all, is the most important thing we can strive to do.

REFERENCES

[1] Ajzen, I. (2001). The Theory of Planned Behaviour. *Journal of Organizational Behaviour and Human Decision Processes*, 179-211.

[2] Biswas, A. (2019, December 20). A nexus between environmental literacy, environmental attitude and healthy living. *Environmental Science and Pollution Research, 27*(6), 5922–5931. https://doi.org/10.1007/s11356-019-07290-5

[3] Chepesiuk, R. (2007). Environmental Literacy: Knowledge for a Healthier Public. *Environmental Health Perspectives*, *115*(10), A494–A499.

[4] Crutzen, P. J., & Stoermer, E. F. (2000). The "anthropocene". *IGBP Newsletter*, 41, 17–18.

[5] Dunlap, R. E., Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring Endorsement of the New Ecological Paradigm :A Revised NEP Scale. *Journal of Social Issues, 56*(3), 425-442.

[6] Education, N. A. A. F. E. (2022, March 31). Environmental Education Programs: Guidelines for Excellence. Retrieved from http://books.google.ie/books?id=4wf4zgEACAAJ&dq=NAAEE+(North+American+Association+for+Environmental+Education)+(2000/2004)+Excellence+in+environmental+education:+guidelines+for+learning+(K-12).+NAAEE,+Washington,+D.+C.,+USA.&hl=&cd=2&source=gbs_api

[7] Elhacham, E., Ben-Uri, L., Grozovski, J., Bar-On, Y. M., & Milo, R. (2020). Global human-made mass exceeds all living biomass. *Nature, 588*(7838), 442-444. https://doi.org/10.1038/s41586-020-3010-5

[8] Ha, C., Huang, G., Zhang, J., & Dong, S. (2021, October 26). Assessing ecological literacy and its application based on linguistic ecology: a case study of Guiyang City, China. *Environmental Science and Pollution Research, 29*(13), 18741–18754. https://doi.org/10.1007/s11356-021-16753-7

[9] Haff, P. K. (2014). Technology as a geological phenomenon: Implications for human well-being. *Geological Society, London, Special Publications*, *395*(1), 301-309. http://dx.doi.org/10.1144/SP395.4

[10] Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy*. North American Association for Environmental Education. Retrieved from https://cdn.naaee.org/sites/default/files/inline-files/devframewkassessenvlitonlineed.pdf

[11] Huang, G. W., & Xiao, J. Y. (2017). The concept of "anthropocene" and ecolinguistic studies. *Foreign Language Resources*, 5, (14-17):30.

[12] Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K. H., Haberl, H., & Fischer-Kowalski, M. (2009). Growth in global materials use, GDP and population during the 20th century. *Ecological economics, 68*(10), 2696-2705. https://doi.org/10.1016/j.ecolecon.2009.05.007

[13] Liu, L., & Tobias, G. R. (2024, March). The impact of environmental literacy on residents' green consumption : Experimental evidence from China. *Cleaner and Responsible Consumption*, 12, 100165. https://doi.org/10.1016/j.clrc.2023.100165

[14] Matthews, E., Amann, C., Bringezu, S., Fischer-Kowalski, M., Hüttler, W., Kleijn, R., ... & Weisz, H. (2000). *The weight of nations*. Material outflows from industrial economies World Resources Institute, Washington.

[15] Maurer, M., & Bogner, F. X. (2020, June). Modelling environmental literacy with environmental knowledge, values and (reported) behaviour. *Studies in Educational Evaluation*, 65, 100863. https://doi.org/10.1016/j.stueduc.2020.100863

[16] 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. http://dx.doi.org/10.1890/ES13-00075.1

[17] McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. (2013, May). 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

[18] Meilinda, H., Prayitno, B. A., & Karyanto, P. (2017). Student's Environmental Literacy Profile of Adiwiyata Green School in Surakarta, Indonesia. *Journal of Education and Learning, 11*(3), 299-306.

[19] Morrone, M. K., Mancl, K., & Carr, K. (2001). Development of a metric to test group differences in ecological knowledge as one component of environmental literacy. *Journal of Environmental Education*, 32, 33–42.

[20] Moseley, C. (2000). Teaching for environmental literacy. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 74*(1), 23-24.

[21] North American Association for Environmental Education (NAAEE). (2011). *Developing a framework for assessing environmental literacy: executive summary.* NAAEE. Retrieved from https://cdn.naaee.org/sites/default/files/inline-files/devframewkassessenvlitonlineed.pdf

[22] North American Association for Environmental Education (NAAEE). (2000/2004). *Excellence in environmental education: guidelines for learning (K–12)*. NAAEE. Retrieved from https://dg56ycbvljkqr.cloudfront.net/sites/default/files/eepro-post-files/k-12_ee_guidelines_for_excellence_2019_4.pdf

[23] Petrović, N. (2016). *Environmental management* (3rd ed.). Belgrade. [In Serbian]
[24] Radaković, J. A., Petrović, N., Milenković, N., Stanojević, K., & Đoković, A. (2017, November 7). Improving Students' Higher Environmental and Climate Change Knowledge: A Case Study. *Polish Journal of Environmental Studies*, *26*(6), 2711–2719. https://doi.org/10.15244/pjoes/69645
[25] Robinson, D. (2024, March 4). *15 Biggest Environmental Problems of 2024 | Earth.Org*. Earth.Org. Retrieved from https://earth.org/the-biggest-environmental-problems-of-our-lifetime/
[26] Roth, C. E. (1968). On the road to conservation. *Massachusetts Audubon*, 38–41.
[27] Roth, C. E. (1992). *Environmental literacy: it's roots, evolution, and direction in the 1990s*. ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
[28] Scholz, R. W. (2011). *Environmental literacy in science and society: from knowledge to decisions*. Cambridge University Press, Cambridge.
[29] Scholz, R. W. (2011). *Environmental literacy in science and society: from knowledge to decisions*. Cambridge University Press.
[30] Simmons, D. (1995). *Papers on the development of environmental education*. North American Association for Environmental Education.
[31] Smil, V. (2012). *Harvesting the biosphere: what we have taken from nature*. Mit Press.
[32] Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The anthropocene: are humans now overwhelming the great forces of nature? *Ambio*, 36, 614–621.
[33] Stephens, L., Fuller, D., Boivin, N., Rick, T., Gauthier, N., Kay, A., ... & Ellis, E. (2019). Archaeological assessment reveals Earth's early transformation through land use. *Science*, *365*(6456), 897-902. https://doi.org/10.1126/science.aax1192
[34] Stibbe, A. (2009). *The handbook of sustainability literacy: skill for a changing world*. Green Books, Dartington.
[35] Watts, J. (2021, October 29). *Human society under urgent threat from loss of Earth's natural life*. The Guardian. Retrieved from https://www.theguardian.com/environment/2019/may/06/human-society-under-urgent-threat-loss-earth-natural-life-un-report?CMP=share_btn_url
[36] Zalasiewicz, J., Waters, C. N., Williams, M., & Summerhayes, C. P. (Eds.). (2019). *The Anthropocene as a geological time unit: a guide to the scientific evidence and current debate*. Cambridge University Press. https://doi.org/10.1017/9781108621359