



Open Access

QLANTIC
 JOURNAL OF
 SOCIAL SCIENCES

Developing Environmental Literacy through Classroom Activities among 8th Graders: An Action Research

Farzeen Fazal¹ Maimoona Naeem² Fareeha Sherazi³

Abstract: *This contemporaneous study investigates the effect of classroom activities in developing environmental literacy among 8th-grade students of Govt. Boys High School, Bagrian. The research discovers the effect of classroom activities on participants' environmental literacy. A single-group pre-test and post-test experimental research design was applied. The data was assembled through an MCQ test to provide a comprehensive understanding of the outcomes. Participants who took the test were the 20 students of 8th Grade of Govt. High School Bagrian, Lahore. The participants were selected as a result of purposive sampling. After two months of treatment, the data was collected for post-test and then analyzed through both descriptive and inferential statistics. After the analyses, it was concluded that classroom activities can positively increase environmental literacy among students. The study's recommendations advocate for the integration of diverse activities in formal educational classrooms, which emphasizes the need for sustained engagement in environmental awareness activities to ensure positive effects. This research could contribute to the broader discourse on environmental literacy offering practical insights for educators, policymakers, and community organizations striving to cultivate environmentally literate and engaged citizens.*

Key Words: Environmental Literacy, Community Service Projects, Citizen Science Initiatives, Digital Platforms, Cultural Nuances, Sustained Engagement, Policymakers, Community Organizations, Environmentally Literate

Introduction

In the face of unprecedented environmental challenges, promoting environmental literacy has become essential to educate informed and responsible global citizens. literacy about the environment is more than just awareness. It encompasses a deep understanding of the interrelationships between human society and the natural world and enables individuals to make informed decisions that promote sustainability (Orr, 1992). This study considers the potential of different activities as effective tools for developing environmental literacy among different populations.

Traditional classroom learning has limitations in teaching environmental literacy because the abstract nature of environmental issues requires a more immersive and experiential approach. Activities ranging from field trips to hands-on projects have shown promise in increasing learner motivation and fostering deeper connections with nature Integrating activities into educational frameworks can increase the effectiveness of environmental education and provide learners with concrete experiences that contribute to their overall understanding (Folke et al. 2016).

Environmental issues and concerns are becoming increasingly important in the modern world. Climate change, biodiversity loss, and pollution are just some of the urgent challenges that require our attention and action (Folke et al., 2016; Rockström et al., 2009).

To effectively address these challenges, it is imperative that individuals have the knowledge, awareness, and skills to understand and respond to environmental issues. This requires the creation of a

¹ Student, Division of Education, University of Education, Lahore, Punjab, Pakistan.

² Lecturer, Division of Education, University of Education, Lahore, Punjab, Pakistan.

³ PhD Scholar, University of Management and Technology, Lahore, Punjab, Pakistan.

▪ **Corresponding Author:** Farzeen Fazal (farzeenfazal97@gmail.com)

▪ **To Cite:** Fazal, F., Naeem, M., & Sherazi, F. (2023). Developing Environmental Literacy through Classroom Activities among 8th Graders: An Action Research. *Qlantic Journal of Social Sciences*, 4(4), 379-388.

<https://doi.org/10.55737/qjss.572718018>



healthy environmental culture, defined as "the ability to critically evaluate and engage with environmental issues" (Naveh & Lieberman, 2013).

As society grapples with complex environmental issues, there is a growing realization that traditional classroom education alone is insufficient to develop individuals' environmental knowledge. The limitations of the formal education system become apparent as it often fails to engage individuals in ways that foster a genuine connection with the environment. Practical experience and active participation are necessary to create a better understanding of environmental problems (Gifford et al. 2011).

Climate change, biodiversity loss, and increased pollution have made the need for environmental literacy more urgent than ever. A lack of understanding of environmental issues undermines the ability of individuals to meaningfully contribute to sustainable solutions (Disinger, 1996). Improving environmental literacy is not just an educational goal, but a fundamental necessity to meet the complex environmental problems of the 21st century (Coyle, 2005; Dada et al., 2017; Gough, 2013).

The goal is to "examine the effect of various activities on the development of environmental literacy". Activities such as community-based conservation projects, nature-based storytelling, and green initiatives are analyzed for their ability to improve environmental knowledge, attitudes, and behavior. By examining the results of these activities, we aim to identify best practices and recommendations for educators and policymakers. This research is important for informing educational practices that respond to the urgent need to promote an environmentally conscious population. By understanding the effectiveness of different activities, educators can adapt their approaches to make room for learners and provide a better foundation to achieve the broader goal of building a sustainable future

Traditional classroom education is often insufficient to provide a deep understanding of environmental issues, leaving people unable to understand, critically evaluate, and actively contribute to sustainable solutions. This deficiency is particularly worrying given the complexity and urgency of current environmental issues. Furthermore, the diversity of environmental issues requires a multifaceted approach to education and requires the search for alternative methods. The problem is further exacerbated by a limited understanding of how different activities contribute to environmental literacy, hindering the development of effective educational strategies.

A distinct absence of research that comprehensively inspects the impact of activities such as outdoor field trips, community service projects, citizen science initiatives, and digital platforms to develop environmental literacy. Understanding the effectiveness of these activities is critical for educators, policymakers, and community organizations seeking to improve environmental education programs.

Additionally, there is a lack of knowledge about how cultural and geographic factors influence the outcomes of these activities, limiting the ability to adapt strategies to different contexts. Therefore, the most important problem is the insufficient environmental literacy of individuals and the need to comprehensively consider different activities as possible solutions, taking into account demographic, cultural, and geographical differences. Addressing this issue is essential to fostering a more informed, proactive, and environmentally responsible society that is able to address and reduce environmental problems (Jasim, 2011).

Background and Objective of the Study

The researcher as a teacher observed her students were not aware of environmental knowledge; they did not possess environmental literacy. In that context, it is clear that there was an urgency to address environmental literacy issues like environment variation, habitat destruction, and pollution. If the critical problem of insufficient environmental literacy among students remains the same it can cause further health issues.

The sole objective of the current research is to scrutinize "the effect of various classroom activities on environmental literacy among students of 8th grade". Activities such as experiential learning, community participation, and digital platforms were used to promote environmental literacy. The null hypothesis of the study was the following

H₀₁: There is no major influence of classroom activities on climate education among students in 8th grade.

The intention was to go beyond theoretical knowledge and explore ways to enable individuals to take informed and sustainable action in their daily lives. This research aims to provide a more informed education by addressing the limitations of traditional education and exploiting the possibilities of diverse activities, with the broader goal of building a proactive and environmentally conscious society.

This research explores the idea that environmental knowledge can be developed through diverse activities that immerse individuals in real-world environmental challenges, encouraging critical thinking and promoting sustainable behaviors.

Promoting environmental literacy is paramount for individuals to understand, critically evaluate, and actively contribute to sustainable solutions (Naveh & Lieberman, [2013](#)).

Review of Literature

“Environmental education” is a process aimed at developing a world that is familiar with such education and concerned about the environment and its linked problems, the population should possess the knowledge, attitudes, motivations, commitments, and skills to work individually and collectively toward solutions of current environmental problems and the prevention of new ones. (Gough, [2013](#))

In the contemporary era, Pakistan has become the world's fifth maximum populous state, surpassing Brazil in early 2020, boasting a population exceeding 204 million people (World Population Review, 2020). The nation features a varied landscape, ecosystems, and societies, with climate and temperature zones mirroring the diversity of its topography. The northern regions exhibit cooler climates, while the plains and coastal areas experience hot and dry conditions. According to a 2005 report from the Pakistan Environmental Protection Agency, the country grapples with swift climate change, a shortage of clean consumption of water, biodiversity harm, increased population, deforestation, and various forms of atmospheric pollution. Environmental challenges extend to pollution in land, water, and noise, as highlighted in the 2005 report from the “Environmental Protection Agency (EPA)” of Pakistan. Recent studies suggest that climate change in Pakistan could lead to substantial economic, social, and environmental consequences, adversely affecting the population (Khan, [2016](#)).

Hence, the impact of universal warming and temperature transformation is predominantly noticeable in Pakistan, accentuated by a reliance on inadequate coping mechanisms for subsistence conditions, pervasive poverty, a high rate of population growth, and the swift consequences of environmental change. Over the past century, a usual annual temperature increase of 0.6°C has been documented (Khan, 2016), while in 2006, "the United Nations Development Programme (UNDP)" testified an average temperature rise of "0.08°C each decade in Pakistan (Stokes et al., [2001](#)). Despite Pakistan's relatively low contribution to greenhouse gas emissions compared to other nations, these emissions exert a significant influence on climatic conditions. The rapid swings in temperature, particularly in the south and north of the country with ratios of “0.6 and 0.8” (Stokes et al., [2001](#)), have resulted in a considerable economic toll, accounting for about “5%” of the gross domestic product (GDP) and nearly \$5 billion. Over the past two years, more than 10 million people have been displaced due to the effects of catastrophic climate change (Climate Emergency Institute, 2017). As per “Vulnerability Index 1”, Pakistan holds the 12th position amongst 193 countries worldwide, experiencing a monetary loss of approximately \$4.5 billion. The ongoing rise in temperatures and diminishing surface water attributed to extensive climate change are anticipated to inflict even greater hardships on agriculture and livestock production in the country (Parveen & Ahmad, [2020](#)).

Al-Khalwaldeh (2000) undertook a study to estimate the environmental literateness of science instructors in Jordan. The survey revealed a moderate level of environmental literacy amongst the participants. Additionally, Bataineh's research in 2012 assessed environmental literacy related to sustainable development among leaders of environmental agencies and Jordanian university students. The findings specified that leaders in environmental bodies demonstrated a high level of environmental literacy, whereas the level among university learners was deemed mediocre. Moreover, Al-Dajeh ([2012](#)) explored the environmental competence of prospective teachers, focusing on information, approaches, and interests. The results revealed insufficient knowledge about environmental issues in the sample. However, their attitudes were positive, reflecting a high level of interest in environmental matters, with



the Internet being identified as a crucial source of information. In 2013, Al-Omari and Al-Hawardeh conducted a study examining the environmental literacy of students at Yarmouk University in Jordan. The results indicated that the level of environmental knowledge and attitudes fell below the acceptable threshold (75%), while environmental practices and interest in such issues were considered acceptable.

In a study conducted by O'Brien (2007), the focus was on assessing the environmental information and approach of students at Iowa State University (ISU). The findings revealed a moderate environmental literacy among the students, with a correlation identified between environmental knowledge, students' attitudes, and various demographic features such as age, gender, university, grade level, and early childhood environment and activities. Moreover, Özden (2008) conducted research to gauge the environmental awareness and attitudes of new teachers in Turkey. The results indicated that female students from higher socioeconomic backgrounds exhibited higher environmental consciousness and held a more optimistic approach to environment literacy.

Research delved into the relationship between the level of environmental literacy, awareness of environmental issues, active participation in outdoor environmental activities, and parents' interest in environmental activities. The outcomes revealed a positive correlation between environmental knowledge and the environmental literacy and attitudes of pre-service teachers. Additionally, Öztürk et al. (2013) conducted a study examining the environmental literacy of in-service teachers across various fields in Turkey. The research aimed to identify the impact of certain factors such as gender, academic expertise, and level of environmental literacy. The results indicated that gender, grade level, and specialization had effects on different aspects of environmental literacy.

Joseph, Obrin Nichol, Janggu, and Madi (2013) proposed a study to assess the environmental literacy of business management lecturers in Malaysian universities. The results indicated that their level of environmental literacy was slightly above average, scoring 3.22 out of 5. In another study, Karatekin (2013) explored the environmental literacy of prospective teachers, specifically those focused on classroom teaching, social studies, and geography. The descriptive survey results revealed that geography teachers exhibited a higher level of environmental literacy compared to their counterparts in other disciplines. Furthermore, Liu et al. (2015) conducted research to measure the environmental literacy of school teachers in Taiwan and evaluate the impact of the environmental education policy implemented in 2011. The findings suggested that while students displayed acceptable levels of environmental literacy and attitudes, their engagement in environmental activities was limited. The study also noted that elementary school teachers outperformed middle school teachers, possibly due to their involvement in a teacher preparation program.

In a recent study conducted by Saribas, Kucuk, and Ertpinar in Turkey (2017), the researchers aimed to examine the impact of environmental education courses on the environmental literacy of elementary school teachers. The students were exposed to key concepts in ecology, climate change, and other environmental issues. The researchers utilized measures of environmental literacy and spontaneity before and after the experiment (Musa, 2003). The outcomes revealed an improvement in the participants' attitudes towards the environment; however, there was no notable change in their knowledge and understanding of environmental issues (Jasim, 2001).

Furthermore, Lloyd-Strovas, Moseley, and Arsuffi (2018) undertook a study to assess the environmental literacy of BA/BSc university students, encompassing everyday knowledge, practical knowledge, attitudes, and behaviors. The findings indicated that the average score for the entire test was merely 52%, suggesting a deficiency in environmental knowledge among the students. Despite holding positive attitudes, their scores in terms of environmental knowledge and behavior were notably low.

Methodology of the Study

This action research study focused to solve on real-time problems faced by students. A quantitative approach is involved through the processing, collection, and analysis of quantitative descriptive data. This type of research is characterized by an emphasis on objectivity in statistical analysis, and in the production of numerical results (Creswell, 2022).

The research employed a quantitative experimental research design, specifically utilizing a single-group pretest/post-test experimental design. Such experimental action research designs involve assessing participants as a group both before and after the implementation of an intervention or treatment. This design is commonly employed to gauge the effectiveness of an intervention by comparing the outcomes of participants before and after the treatment. (Cohen et al., 2018; Creswell & Creswell, 2022). The Pre-test worked as a baseline and the post-test helped in direct comparison within a group of participants. The design provides a strong internal validity as well. A single-group design is well-aligned with the objective of the study, focusing on the direct impact of an intervention within the specific context where it is implemented (Gill, 2018).

The actual population for action research was conducted on a single class of 8th-graders of Govt. High School, Bagrian Lahore. In this context, the entire 8th grade, including all individual students, could be considered to generalize the study. This allowed for a focused and targeted investigation into the effects of the action research within the confines of that particular classroom setting. The research findings and interventions implemented would be directly applicable to the students in that class, and the insights gained may inform future practices within that specific educational context.

The study utilized the purposive sampling technique to select participants, with the researcher specifically choosing 20 students from Grade 8th section B, as outlined by Purposive sampling, also known as selective sampling, which is a non-probability sampling method where researchers intentionally choose participants based on specific criteria related to the research question or purpose. In contrast to random sampling, where all members of the population have an equal chance of being selected, purposive sampling deliberately selects individuals with certain characteristics or experiences deemed crucial to the study.

This study used MCQ tests as the data collection method. This adapted test from O'Brien (2007) also involved guidance for students on how to respond to a specific item. This approach provides insight into students' understanding and comprehension of the topic. Participants were encouraged to do their best. The tool used to assess knowledge contains 15 items, each with one letter and five options. The time allotted for the test was 30 minutes. "MCQs" stands for multiple choice questions. In this format, candidates are provided with a question or statement and are required to choose the correct answer from a list of options provided. Each question typically has a stem (the body of the question) and a number of choices, of which only one is the correct or most appropriate answer. MCQs are widely used in various educational institutions such as schools, universities, and professional exams, as they provide a structured and efficient way to assess an individual's knowledge on a particular topic. Two experts were consulted to determine the content validity of questionnaire test items. The reliability of the instrument was assessed using Cronbach's alpha, a widely utilized statistic for measuring internal consistency (Creswell, 2009).

Cronbach's alpha calculates the average correlation among all possible pairs of items on a scale. The alpha coefficient ranges from 0 to 1, with higher values indicating greater internal consistency. In this case, Cronbach's alpha value was 0.78, suggesting a moderate to good level of internal consistency for the instrument. A commonly accepted threshold for good internal consistency is around 0.70 or higher, but the acceptable level may vary depending on the context (Creswell, 2009).

There were numerous classroom activities that were used to develop environmental literacy through teaching the course of General Science. The activities included discussions, recycling, initiating zero-waste challenges, tree planting projects, gardening, and environmental art projects. The students learned about the environment through various science projects and energy conservation initiatives. These activities helped in developing a more sensible perspective about the environment as a whole and the factors that influenced it negatively with their countermeasures. To promote environmental literacy in the classroom, a variety of engaging activities were commenced that assisted in fostering a deeper understanding of environmental issues. An effective approach used to incorporate nature-based experiences, was regular outdoor explorations, nature walks, and field trips to local parks and preserves. These activities not only connected students with the environment but also provided hands-on opportunities to observe and understand the complexity of ecosystems. By incorporating hands-on initiatives such as community clean-ups and waste audits, students directly participated in addressing local environmental issues and learning about the impact of human activities on their surroundings.



Moreover, class projects, including tasks like crafting eco-friendly art installations, planning sustainable gardens, and executing energy-saving experiments, offered students a practical outlet to apply their theoretical knowledge in real-life scenarios. Reading and discussing environmental literature, documentaries, and news articles deepened my understanding and critical thinking skills. Interactive workshops led by experts and experts in the field provided valuable insight and allowed students to engage with real-world environmental problems. By integrating these diverse activities, a dynamic learning environment was created within and without the classroom that not only imparted knowledge but also instilled in students a sense of responsibility and a commitment to sustainable practices, thereby creating a balanced contribution to the development of individuals with high environmental awareness.

Data Analysis and Interpretation

Table 1

Items	Pre-Test Total Percentage Scores	Post-Test Total Percentage Scores
1.	14.1	44.1
2.	25.2	48.3
3.	16.8	47.2
4.	23.1	43.0
5.	21	44.6
6.	18.3	39.9
7.	24.6	40.4
8.	19.4	44.1
9.	21.5	50.9
10.	17.85	47.5
11.	24.1	40.9
12.	18.3	42
13.	15.2	46.6
14.	19.9	39.3
15.	21	48.3

The Pre-test analysis showed that most of the students were unaware of the concept of environmental literacy with a very low score on the test. That was clearly indicated by the table 1. That pushed to researcher to implement an intervention plan involving some classroom activities for the students to be more knowledgeable about their environment.

The post-test results of the study unequivocally demonstrated an enhancement in the environmental literacy of the students. The students were showing a better percentage of knowledge about the environment. This clearly indicated that students were much more aware of their environment and how different activities helped to make it better.

Results

As a result, the data analysis of test scores, average percentages, and total percentages for 20 students across 15 statements provides valuable insights into the students' performance. These findings can serve as a foundation for further investigations, interventions, and instructional improvements to enhance overall academic outcomes.

- Item 1: The pretest score was 14.1% whereas the post-test score was 44.1%.
- Item 2: The pretest score was 25.2% whereas the post-test score was 48.3%.
- Item 3: The pretest score was 16.8% whereas the post-test score was 47.2%.
- Item 4: The pretest score was 23.1% whereas the post-test score was 43.0%.
- Item 5: The pretest score was 21% whereas the post-test score was 44.6%.
- Item 6: The pretest score was 18.3% whereas the post-test score was 39.9%.
- Item 7: The pretest score was 24.6% whereas the post-test score was 40.4%.
- Item 8: The pretest score was 19.4% whereas the post-test score was 44.1%.

- Item 9: The pretest score was 21.5% whereas the post-test score was 50.9%.
- Item 10: The pretest score was 17.85% whereas the post-test score was 47.5%.
- Item 11: The pretest score was 24.1% whereas the post-test score was 40.9%.
- Item 12: The pretest score was 18.3% whereas the post-test score was 42%.
- Item 13: The pretest score was 15.2% whereas the post-test score was 46.6%.
- Item 14: The pretest score was 19.9% whereas the post-test score was 39.3%.
- Statement 15: The pretest score was 21% whereas the the post-test score was 48.3%.

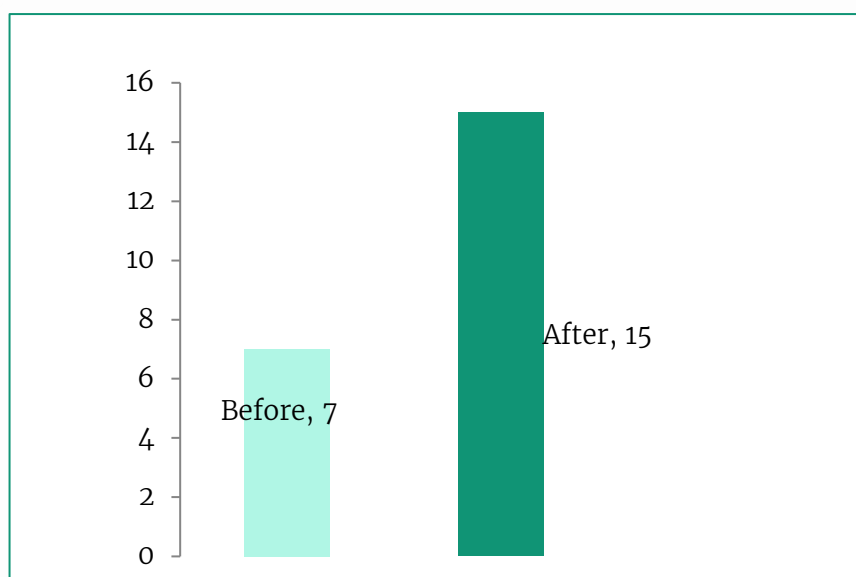
Table 2

Paired Sample T Test

Tests	Mean	n	Std. Deviation
Pre-Test	7.0	20	2.323
Post-Test	15.4	20	2.187

Figure 1

Comparison of Students' Mean Scores Before and After Treatment



The mean score was $M = 7$ for $n=20$ in the Pre-test but there was a massive improvement in the post-test as $M= 15$. It clearly depicts that classroom activities positively affect and increase environmental literacy among students.

Conclusion

The Pre-test of the study sheds light on a crucial drawback, revealing the deficiency in environmental literacy among the 8th-grade students. By creating an adequate atmosphere that provides an understanding of environmental literacy, assisted the students in having better environmental literacy through classroom activities.

Discussion

From previous studies, it can be concluded that the level of environmental literacy is moderate (O'Brien, 2007; Al-Hawardeh, 2000) or falls below acceptable levels (Al-Omari & Al-Khawaldeh, 2013; Al Dajeh, 2012). On the other hand, other studies have reported positive attitudes toward the environment (Al Dajeh, 2012), while some have shown that environmental practices are below satisfactory levels (Liu et al., 2016).

Several studies have identified a connection between environmental literacy and teacher characteristics, including factors such as age, gender, socioeconomic level, specialization, previous knowledge, or participation in university environmental education courses (O'Brien, 2007; Karatekin,



2013). The majority of these studies utilized environmental literacy questionnaires as a means to gather data on knowledge, attitudes, awareness, and behavior.

The pretest analysis of this study revealed a significant lack of environmental literacy awareness among grade 8 students as evidenced by low test scores, and the results are shown in column 2 Backed by data. In response to this significant shortcoming, researchers have implemented intervention plans and introduced various classroom activities aimed at increasing students' knowledge of their environment. Subsequent post-test results showed significant improvements in students' environmental literacy, indicating increased environmental awareness and understanding.

This study highlights the inadequacy of traditional educational approaches in addressing today's complex environmental issues and emphasizes the need for diverse activities to close the environmental literacy gap. In particular, classroom activities such as reusing and recycling are emphasized as important for increasing students' environmental awareness.

Additionally, this study addresses diverse environmental education contexts and investigates the impact of various activities such as outdoor field trips, community service projects, citizen science initiatives, and digital platforms on middle and high school students' environmental knowledge, attitudes, and behaviors. The results highlight the need to adapt educational strategies to different cultural and geographic contexts and to recognize the diverse influences that influence environmental outcomes. This nuanced awareness is critical for educators, policymakers, and community organizations seeking to develop effective and culturally appropriate environmental literacy programs.

This study also highlights the importance of continued participation in these activities and points to the potential long-term impact on participants' conservation efforts. Furthermore, this study provides practical recommendations for educators to integrate various activities into formal education to promote a holistic approach to developing environmental literacy. Policymakers are encouraged to advocate for the standardization and integration of environmental literacy programs, and community organizations are encouraged to partner with educational institutions to increase community engagement. This comprehensive study not only contributes to the academic understanding of environmental education but also provides practical insights for practitioners aiming to develop a generation that is knowledgeable and engaged about the environment. Ultimately, this study aims to reshape the environmental education paradigm by imagining a more sustainable and harmonious human-environment relationship and promoting coexistence by addressing the complex environmental challenges of our time and promoting activation.

References

- Al-Dajeh, H. I. (2012). Assessing environmental literacy of Pre-Vocational education teachers in Jordan. *College Student Journal*, 46(3), 492–507. <https://eric.ed.gov/?id=EJ996949>
- Al-Omari, A., & Al-Khawaldeh, S. A. (2013). Environmental literacy among students of the faculty of education at Yarmouk University. *Journal of Educational and Psychological Studies [JEPS]*, 7(2), 133–150. <https://doi.org/10.24200/jeps.vol7iss2pp133-150>
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.
- Coyle, K. (2005). *Environmental literacy in America: What ten years of NEETF/Roper research and related studies say about environmental literacy in the U.S.* National Environmental Education Training Foundation.
- Creswell, J. W. (2009). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Sage.
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage.
- Dada, D. O., Eames, C., & Calder, N. (2017). Impact of environmental education on beginning preservice teachers' environmental literacy. *Australian Journal of Environmental Education*, 33(3), 201–222. <https://doi.org/10.1017/aee.2017.27>
- Derman, A., & Hacıeminoğlu, E. (2017). Sürdürülebilir Gelişme İçin Eğitim Bağlamında Sınıf Öğretmenlerinin Çevre Okuryazarlığı Düzeyleri. *Ondokuz Mayıs University Journal of Education Faculty*, 36(2), 81–103. <https://doi.org/10.7822/omuefd.373029>
- Disinger, J. F. (2001). K-12 education and the environment: perspectives, expectations, and practice. *The Journal of Environmental Education*, 33(1), 4–11. <https://doi.org/10.1080/00958960109600795>

- Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. *Ecology and Society*, 21(3). <https://doi.org/10.5751/es-08748-210341>
- Gifford, R., Steg, L., & Reser, J. P. (2011). *Environmental psychology*. IAAP handbook of applied psychology, 440-470.
- Gill, P., & Baillie, J. (2018). Interviews and focus groups in qualitative research: an update for the digital age. *British Dental Journal*, 225(7), 668-672.
- Gough, A. (2013). The emergence of environmental education research. *International handbook of research on environmental education*, 13, 452-468.
- Jasim, S. A. (2001). Environmental Literacy of Teachers of Science In The Intermediate Stage In The State of Kuwait. *Journal of Educational and Psychological Sciences*, 02(01). <https://doi.org/10.12785/jeps/020105>
- Joseph, C., Obrin Nichol, E., Janggu, T., & Madi, N. (2013). Environmental literacy and attitudes among Malaysian business educators. *International Journal of Sustainability in Higher Education*, 14(2), 196-208. <https://doi.org/10.1108/14676371311312897>
- Karatekin, K. (2013). Comparison of Environmental Literacy Levels of Pre-service Teachers. *International Journal of Academic Research*, 5(2). <https://doi.org/10.7813/2075-4124.2013/5-2/B.1>
- Khan, S. M. M. H. (2016). Environmental education and awareness. *Bangladesh National Conservation Strategy, Ministry of Environment and Forest, Bangladesh*.
- Liu, S. Y., Yeh, S. C., Liang, S. W., Fang, W. T., & Tsai, H. M. (2015). A national investigation of teachers' environmental literacy as a reference for promoting environmental education in Taiwan. *The Journal of Environmental Education*, 46(2), 114-132. <https://doi.org/10.1080/00958964.2014.999742>
- Lloyd-Strovas, J., Moseley, C., & Arsuffi, T. (2018). *Environmental literacy of undergraduate college students: Development of the environmental literacy instrument (ELI)*. *School Science and Mathematics*, 118(3-4), 84-92. <https://doi.org/10.1111/ssm.12266>
- Musa, M. A. (2003). *Environmental literacy and the mass media: An analytical study*. Thesis, University of Jordan.
- Naveh, Z., & Lieberman, A. S. (2013). *Landscape ecology: theory and application*. Springer Science & Business Media.
- O'Brien, S. R. M. (2018). *Indications of environmental literacy: using a new survey instrument to measure awareness, knowledge, and attitudes of university-aged students*. <https://doi.org/10.31274/rtd-180813-16190>
- Orr, D. W. (1991). *Ecological literacy: Education and the transition to a postmodern world*. State University of New York Press.
- Özden, M. (2008). Environmental awareness and attitudes of student teachers: *An empirical research*. *International Research in Geographical and Environmental Education*, 17(1), 40-55. <https://doi.org/10.2167/irgee227.0>
- Öztürk, G., Yılmaz Tüzün, Ö., & Teksöz, G. (2013). Exploring Environmental Literacy through Demographic Variables. *Elementary Education Online*, 926-937. <https://hdl.handle.net/11511/80656>
- Parveen, R., & Ahmad, A. (2020). Public behavior in reducing urban air pollution: An application of the theory of planned behavior in Lahore. *Environmental Science and Pollution Research*, 27(15), 17815-17830. <https://doi.org/10.1007/s11356-020-08235-z>
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., ... & Foley, J. (2009). *Planetary boundaries: exploring the safe operating space for humanity*. *Ecology and Society*, 14(2). <https://doi.org/10.5751/es-03180-140232>
- Roth, C. E. (1992). *Environmental literacy: Its roots, evolution, and directions in the 1990s*. <http://files.eric.ed.gov/fulltext/ED348235.pdf>
- Saribas, D. (2015). Investigating the Relationship between Pre-Service Teachers' Scientific Literacy, Environmental Literacy, and Life-long Learning Tendency. *Science Education International*, 26(1), 80-100.
- Saribas, D., & Gonca Akdemir, Z. (2019). Using an innovative tool in science education: examining pre-service elementary teachers' evaluation levels on the topic of wetlands. *International Journal of Science Education*, 41(1), 123-138. <https://doi.org/10.1080/09500693.2018.1536302>



- Saribas, D., Kucuk, Z. D., & Ertepinar, H. (2017). Implementation of an environmental education course to improve pre-service elementary teachers' environmental literacy and self-efficacy beliefs. *International Research in Geographical and Environmental Education*, 26(4), 311-326. <https://doi.org/10.1080/10382046.2016.1262512>
- Stokes, E., Edge, A., & West, A. (2001). *Environmental education in the educational systems of the European Union*. Environment Directorate-General, European Commission.