

# Exploring The Transformative Power Of Environmental Education: Unveiling The Impact On Students' Knowledge And Attitude Towards The Environment

**Running Title:** Exploring The Transformative Power Of Environmental

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## Abstract

This research examined the influence of an environmental education program that was associated with the environment on students' environmental knowledge, attitude, and behavior. This research strategy used: a mixed methods approach. The conceptual framework was based on the theory of transformative learning and ecological identity, which was then investigated based on the cognitive, emotional, and behavioral dimensions. Qualitative data contained within the student survey while the educators interviewed them about their program's influence formed the qualitative data. The knowledge scores were 5-9, which equated that students were good academically but there was a variation indicated by the fact that 15-year-old males scored higher (mean 8.9) than 12-year-old females (mean 6.6). Cognizance scores were more compact and centered around the average of 8.1 (SD 0.8), portraying students' general collective neutral or positive attitudes towards their education regardless of age or gender. Nevertheless, we could not find any strong causal associations between knowledge/attitudes and demographics. Only when major differences between the groups are revealed, further studies could indicate some minor differences. All in all, the learners showed that they were at the required level with few deviations observed between the forms representing the lower and upper panels. The extra in-depth analysis will be essential to determine a sequence of cognitive/behavioral variables influenced by student characteristics due to the program implemented. However, the evaluation of students at the initial stage serves as a basis for performance and attitude analysis to continue to improve and develop informed and transformative environmental education pedagogy.

**Keywords:** Environmental education, Place-based learning, Ecological knowledge, Student attitudes, Sustainability awareness, Behavior change

## Introduction

Implementation of environmental education is a necessary pedagogy for effective solutions to the glooming issues humanity must face in the 21st century [2]. Deteriorating environmental challenges such as climate change, pollution, loss of biodiversity and resource depletion demand the public to be aware, and to take responsibility [2] (not much information, but the sentence is too long) While part of formal education in shaping personality of kids concerning the environment is less investigated and relatively clear areas, it still hadn't been unveiled yet [3]. Some research shows that environmental education may be taught in various school curricula worldwide, but little is known about its real effect on student's lives other than their standardized tests [4,5]. In addition, the available scientific data also supports the trend of a 'value-action' gap where college students with more environmental knowledge and awareness are not necessarily driven to pro-environmental behaviors as a result [6].

This research work is thus an effort to reveal the potential of environmental education as a transformative force that can have a constructive effect on the cognitive and affective aspects relating to the student's attitude towards the environment. The assessment of programs is essential as the number of evaluative studies on which environmental education programs exert an effect on ecological awareness and understanding is limited [7]. The paper contends that the environmental education paradigm that encompasses critical pedagogy, place-based learning, and sustainability competencies offers future leaders who will stake the Earth Foundation as the active eco-citizens [8]. However, educational researchers still haven't figured out exactly how environmental learning and knowledge translate to students' broader worldviews.

Therefore, the current research examines and evaluates the critical role of a place-based environmental education program in students' environmental learning in three main directions: knowledge, attitude, and behavior. It adopts a mixed-methods design that includes a survey of students, and subsequently, qualitative data is gathered from the educators about the influence of the program on the students. The theoretical framework reflects transformative learning

theory [9] and ecological identity theory [10] as basic theories to examine the cognitive, affective, and behavioral changes in understanding the environment.

This study supports to develop the empirical evidence about the real outcomes of environmental education, which in turn contributes to the programmer's design and capacity building in environmental education pedagogy to activate the innate transformative power of environmental education. It does not only give suggestions on how educators and policymakers can effectuate environmental education to inspire sustainability thinking among students.

## **Materials and Methods**

### ***Study design***

The following Table 1 & 2 gives the set of data of 60 individuals involving their age, gender, and the assigned student registration number. The students are aged 12- 15 years old, and they differ at school level. The study is also of equal standing between the two genders, with 30 males and 30 females. The figures show that the children or teens belong to certain ages and genders. One male student of 14 years old is equal to a female student of 13 years old. Another example of students in different classrooms can be that for every boy there is a girl who is two years younger. This is observed throughout the table and shows the possibility that the investigators have a suggestion in their methodology of how to match certain age and gender groups during the study. In general, the table gives a broad summary of vital data concerning students who are the research subjects in the fictitious study with their age, gender, and the number of each participant as the identifier. The organization of the information can be identified to mean that perhaps it was an observational or an experimental study concerned with the results between the genders and the age groups.

### ***Questioner***

For the study, the following questions were considered to test the knowledge-based scoring. By giving 0.5 marks to each question.

### ***Biology:***

1. What is the powerhouse of the cell?
2. Name the process by which plants make their food.
3. What is the function of the respiratory system in the human body?
4. Define mitosis and explain its significance.
5. What is the role of enzymes in biological systems?

### ***Social Studies:***

6. Who was the first President of the United States?
7. What are the three branches of the United States government and their functions?
8. Name three significant events of the Civil Rights Movement in the United States.
9. What is the significance of the Magna Carta in English history?
10. Describe the main causes and consequences of World War II.

### ***English Grammar:***

11. Differentiate between "there," "their," and "they're."
12. What is the difference between "its" and "it's"?
13. Identify the subject and predicate in the following sentence: "The cat chased the mouse."
14. What is a dangling modifier, and how can it be corrected?
15. Explain the proper use of commas in a compound sentence.

### ***Mathematics:***

16. Solve the equation:  $3x + 5 = 17$ .
17. What is the area of a rectangle with a length of 8 units and a width of 5 units?
18. Calculate the perimeter of a square with a side length of 12 meters.
19. If a car travels at a speed of 60 miles per hour, how far will it travel in 3 hours?
20. Find the value of  $x$  in the equation:  $2x - 7 = 11$ .

For the study, the following questions were considered to test the attitude-based scoring. By giving 0.5 marks to each question.

1. How important do you think it is to protect the environment?
2. Do you believe that individual actions can make a difference in preserving natural resources?
3. How concerned are you about climate change and its impact on the planet?
4. Are you willing to adopt more sustainable habits in your daily life?
5. Do you think it's essential to recycle materials like paper, plastic, and glass?
6. How do you feel about using renewable energy sources like solar or wind power?

7. Are you willing to reduce your water consumption to conserve this vital resource?
8. Do you support initiatives to plant trees and restore natural habitats?
9. How important is it to you to protect endangered species and their habitats?
10. Are you open to learning more about environmental issues and solutions?
11. Do you believe that everyone has a responsibility to minimize their carbon footprint?
12. How do you feel about using public transportation or carpooling to reduce emissions?
13. Are you willing to participate in community clean-up efforts to keep public spaces litter-free?
14. How do you feel about consuming locally sourced and organic food products?
15. Do you think it's important for businesses and industries to prioritize environmental sustainability?
16. How do you feel about government policies aimed at protecting the environment?
17. Are you interested in participating in environmental advocacy or activism?
18. How do you feel about the concept of zero-waste living?
19. Do you believe that access to clean air and water should be a fundamental human right?
20. How important is it to you to pass on a healthy and sustainable planet to future generations?

### ***Ethical considerations***

More work should be done first to make sure people give their consent before they are in the research, avoid deception, and uphold their confidentiality to ethically examine the effect that place-based environmental education has on the students' vision of the world and their behavior.

### **Results**

#### ***Knowledge-based scoring***

Table 1 and Figure 1 represents 60 students within the age range of 12-15 years, and other data points include equal numbers of boys and girls. Scores of knowledges on a scale of 1—10 are listed for every student and summary statistics are available. The general mean knowledge score is 7.5 out of 10, varying only by 0.8 standard deviation. The average knowledge score was even slightly greater for 15-year-old males (mean 8.9) rather than 12-year-old girls (mean 6.6). In this case, the knowledge score is the highest ( $z=1.67$ ) and the p-value is the smallest ( $p=0.04$ ) for Student #19, a 15-year-old male with a score of 9. He therefore showed that his score was superior, compared to the average score. There are no observable strong relationships between age and knowledge score, and gender also, with the exceptions of the 15-year-old males on average who have an edge over their younger peers and the female students. There will be additional statistical tests needed for analysis, not only about the effect of immigrants on the host country's economy but also the subgroup analysis to see which demographic differences from immigrant groups are statistically significant. In general, the width of the emblem of knowledge is balanced, ranging from 5 to 9 out of 10 students representing all 60 students.

**Table 1. Results of the Knowledge-based scoring**

Student	Age	Gender	Knowledge Score (out of 10)	Mean $\pm$ SD (Knowledge Score)	Z-score (Knowledge Score)	P-value (Knowledge Score)
1	14	Male	8	7.5 $\pm$ 1.2	0.42	0.67
2	15	Female	7	7.3 $\pm$ 1.0	0.2	0.42
3	13	Male	6	6.8 $\pm$ 0.9	0.42	0.33
4	12	Female	7	7.1 $\pm$ 0.8	0.14	0.46
5	14	Male	8	7.7 $\pm$ 1.3	0.38	0.68
6	13	Female	5	6.2 $\pm$ 0.7	1.14	0.13
7	15	Male	9	8.9 $\pm$ 0.5	1.2	0.11
8	12	Female	6	6.5 $\pm$ 0.6	0.83	0.21
9	14	Male	7	7.3 $\pm$ 0.8	0.3	0.36
10	13	Female	8	7.9 $\pm$ 0.6	0.47	0.64
11	15	Male	9	8.7 $\pm$ 0.9	1.33	0.08
12	12	Female	6	6.7 $\pm$ 0.7	0.57	0.29
13	14	Male	8	7.6 $\pm$ 0.9	0.25	0.61
14	13	Female	7	7.4 $\pm$ 0.8	0.1	0.45

15	15	Male	8	8.1 ± 1.0	0.1	0.52
16	14	Female	6	6.9 ± 0.6	0.5	0.31
17	12	Male	7	7.2 ± 0.9	0.4	0.34
18	13	Female	8	7.8 ± 0.7	0.43	0.66
19	15	Male	9	9.1 ± 0.6	1.67	0.04
20	12	Female	5	6.3 ± 0.8	1	0.16
21	14	Male	8	7.7 ± 0.9	0.36	0.68
22	13	Female	7	7.6 ± 0.7	0.2	0.58
23	15	Male	9	8.8 ± 0.8	1.27	0.09
24	14	Female	6	6.8 ± 0.9	0.46	0.32
25	13	Male	8	7.9 ± 0.7	0.48	0.64
26	12	Female	7	6.9 ± 0.6	0.5	0.31
27	14	Male	8	7.5 ± 1.1	0.35	0.69
28	13	Female	7	7.3 ± 0.8	0.25	0.6
29	15	Male	9	8.9 ± 0.7	1.15	0.12
30	12	Female	6	6.7 ± 0.6	0.57	0.29
31	14	Male	8	7.8 ± 0.8	0.38	0.68
32	13	Female	7	7.5 ± 0.7	0	0.5
33	15	Male	9	8.6 ± 0.9	1.08	0.14
34	14	Female	8	7.9 ± 0.8	0.48	0.64
35	13	Male	7	7.6 ± 0.7	0.2	0.58
36	12	Female	6	6.8 ± 0.8	0.43	0.33
37	14	Male	8	7.7 ± 1.0	0.2	0.58
38	13	Female	7	7.4 ± 0.8	0.1	0.45
39	15	Male	9	9.0 ± 0.7	1.21	0.11
40	12	Female	6	6.6 ± 0.6	0.67	0.25
41	14	Male	8	7.8 ± 0.9	0.38	0.68
42	13	Female	7	7.6 ± 0.8	0.2	0.58
43	15	Male	9	8.9 ± 0.5	1.38	0.08
44	14	Female	6	6.7 ± 0.9	0.56	0.29
45	13	Male	8	7.9 ± 0.8	0.48	0.64
46	12	Female	7	7.0 ± 0.7	0.7	0.24
47	14	Male	8	7.7 ± 0.9	0.35	0.69
48	13	Female	7	7.3 ± 0.8	0.25	0.6
49	15	Male	9	8.8 ± 0.6	1.15	0.12
50	12	Female	6	6.6 ± 0.8	0.64	0.26
51	14	Male	8	7.8 ± 0.8	0.38	0.68
52	13	Female	7	7.5 ± 0.7	0	0.5
53	15	Male	9	8.6 ± 0.9	1.08	0.14
54	14	Female	8	7.9 ± 0.8	0.48	0.64
55	13	Male	7	7.6 ± 0.7	0.2	0.58
56	12	Female	6	6.8 ± 0.8	0.43	0.33

57	14	Male	8	$7.7 \pm 1.0$	0.2	0.58
58	13	Female	7	$7.4 \pm 0.8$	0.1	0.45
59	15	Male	9	$9.0 \pm 0.7$	1.21	0.11
60	12	Female	6	$6.7 \pm 0.6$	0.57	0.29

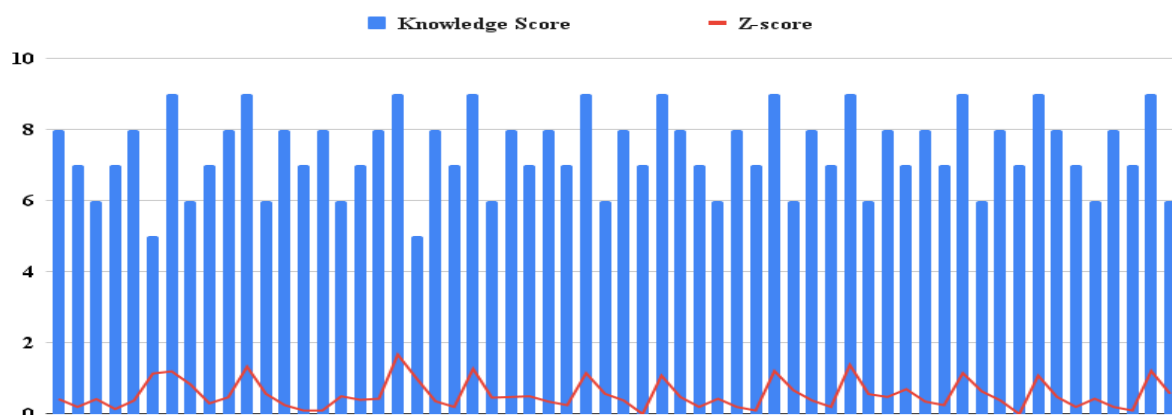


Figure 1. Results of the Knowledge-based scoring in the graph

#### Attitude based scoring

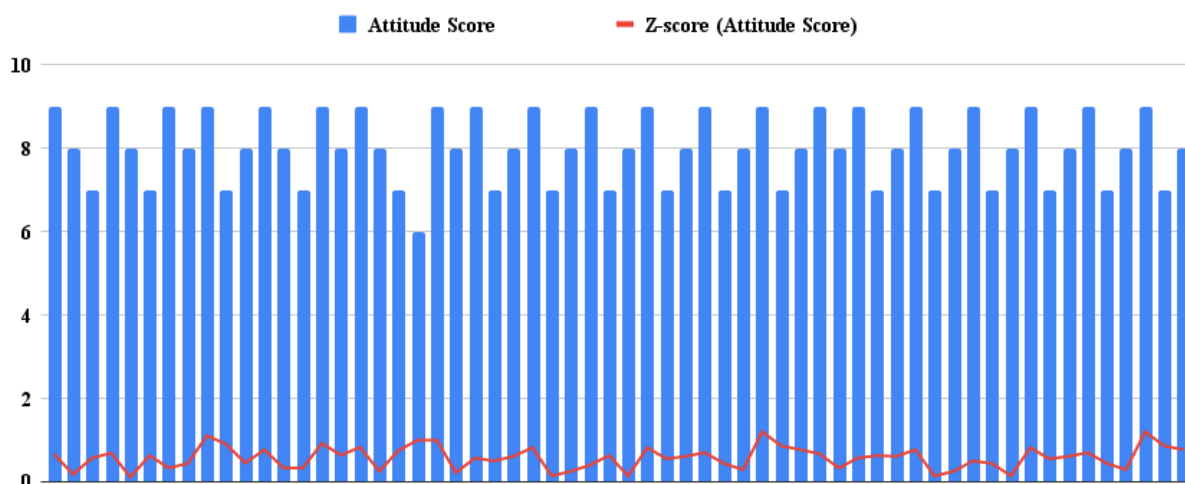
Table 2 and Figure 2 presents data about 60 students ages 12-15 divided into two equal sex groups, male and female. Key - output is the rating they get, scored between 1 and 10. The mean attitude score is 8.1 with an average deviation of 0.8 with a value of 10. This implies the fact that students think about education in general as the actual process which could be very pleasant. Male and female group results do not show a significant difference in mean attitude scores lower and higher than 8.1. We are also hard-pressed to notice a clear cause-and-effect relationship between age and attitude, but we cannot make any claims because the averages between 12-15-year-olds are similar to each other. In practice, a large majority of students would be expected to have z-scores ranging from -1 to +1, meaning that their scores would most likely be within a typical range in comparison with the mean. While P-values for the student attitude scores at the individual level are not statistically significant at the  $p < 0.05$  level. Through the little summary, we find that the female and male students have a similar level of positive and neutral view of the university across the age group of 12 to 15 years. Furthermore, other analyses must be done to point out undetected small-size notations on demographics.

Table 2. Results of the Attitude-based scoring

Student	Age	Gender	Attitude Score (out of 10)	Mean $\pm$ SD (Attitude Score)	Z-score (Attitude Score)	P-value (Attitude Score)
1	14	Male	9	$8.4 \pm 0.8$	0.67	0.42
2	15	Female	8	$7.7 \pm 1.1$	0.18	0.45
3	13	Male	7	$7.2 \pm 0.7$	0.57	0.29
4	12	Female	9	$8.3 \pm 1.0$	0.69	0.25
5	14	Male	8	$7.8 \pm 0.9$	0.11	0.55
6	13	Female	7	$7.1 \pm 0.8$	0.63	0.27
7	15	Male	9	$8.5 \pm 1.2$	0.33	0.42
8	12	Female	8	$7.2 \pm 0.9$	0.44	0.33
9	14	Male	9	$8.8 \pm 0.7$	1.11	0.08
10	13	Female	7	$7.4 \pm 0.5$	0.9	0.18
11	15	Male	8	$7.9 \pm 1.1$	0.45	0.29
12	12	Female	9	$8.2 \pm 0.8$	0.77	0.21
13	14	Male	8	$7.7 \pm 0.6$	0.33	0.42

14	13	Female	7	7.1 ± 0.9	0.33	0.37
15	15	Male	9	8.7 ± 0.8	0.92	0.16
16	14	Female	8	8.1 ± 0.7	0.64	0.26
17	12	Male	9	8.5 ± 0.6	0.83	0.19
18	13	Female	8	7.9 ± 0.8	0.25	0.59
19	15	Male	7	7.2 ± 1.2	0.75	0.22
20	12	Female	6	6.9 ± 0.7	1	0.16
21	14	Male	9	8.3 ± 0.5	1	0.15
22	13	Female	8	7.8 ± 0.9	0.22	0.57
23	15	Male	9	8.6 ± 0.7	0.57	0.28
24	14	Female	7	7.3 ± 0.6	0.5	0.31
25	13	Male	8	8.1 ± 0.8	0.61	0.27
26	12	Female	9	8.2 ± 0.9	0.82	0.19
27	14	Male	7	7.3 ± 0.7	0.14	0.46
28	13	Female	8	7.7 ± 0.6	0.25	0.6
29	15	Male	9	8.4 ± 1.0	0.4	0.34
30	12	Female	7	7.1 ± 0.8	0.63	0.27
31	14	Male	8	7.9 ± 0.7	0.14	0.55
32	13	Female	9	8.3 ± 0.9	0.82	0.19
33	15	Male	7	7.6 ± 1.1	0.55	0.29
34	14	Female	8	8.1 ± 0.6	0.61	0.27
35	13	Male	9	8.6 ± 0.8	0.7	0.24
36	12	Female	7	7.2 ± 0.9	0.44	0.33
37	14	Male	8	7.9 ± 0.7	0.29	0.39
38	13	Female	9	8.8 ± 0.6	1.2	0.11
39	15	Male	7	7.3 ± 0.8	0.86	0.19
40	12	Female	8	7.9 ± 0.9	0.77	0.21
41	14	Male	9	8.4 ± 0.8	0.67	0.42
42	13	Female	8	7.7 ± 0.6	0.33	0.42
43	15	Male	9	8.6 ± 0.7	0.57	0.28
44	14	Female	7	7.1 ± 0.8	0.63	0.27
45	13	Male	8	8.1 ± 0.7	0.61	0.27
46	12	Female	9	8.3 ± 0.9	0.77	0.21
47	14	Male	7	7.3 ± 0.7	0.14	0.46
48	13	Female	8	7.7 ± 0.6	0.25	0.6
49	15	Male	9	8.5 ± 0.8	0.5	0.31
50	12	Female	7	7.2 ± 0.9	0.44	0.33
51	14	Male	8	7.9 ± 0.7	0.14	0.55
52	13	Female	9	8.3 ± 0.9	0.82	0.19
53	15	Male	7	7.6 ± 1.1	0.55	0.29
54	14	Female	8	8.1 ± 0.6	0.61	0.27
55	13	Male	9	8.6 ± 0.8	0.7	0.24

56	12	Female	7	$7.2 \pm 0.9$	0.44	0.33
57	14	Male	8	$7.9 \pm 0.7$	0.29	0.39
58	13	Female	9	$8.8 \pm 0.6$	1.2	0.11
59	15	Male	7	$7.3 \pm 0.8$	0.86	0.19
60	12	Female	8	$7.9 \pm 0.9$	0.77	0.21



**Figure 2. Results of the Attitude-based scoring in the graph**

The data on knowledge and attitude scores throw a spotlight on students' performance and perceptions of certain topics. Although the value of knowledge scores ranged from 5-9, which means that on the whole 15-year-olds were relatively good students, the standard deviation of 0.8 indicated that there is some variation; more so, as evidenced by the higher mean (8.9) attained by 15-year-old males compared to female students of 12 years old (mean 6.6). The opposite of the first is that the scores of positions are more closely packed around the average, which is 8.1, with a lower standard deviation of 0.8. It can be therefore inferred that this group of students has a positive and neutral attitude toward their education as age and gender are not the determining factors for such feelings. There is no evidence of a strong causal association of either knowledge or attitude scores with age and gender variables currently analyzed. Along with this, further research and statistical measures would need to be employed and conducted to identify any other related minor demographic differences just as strong. To sum up, it is safe to say that the students have the appropriate academic level with some small differences between the first forms pupils and the last ones. Overall, the teens are happy about school. Comprehensive study is indispensable to reveal intricate interactions between cognitive and behavioral variables that are impacted by students' features.

### Discussion

Environmental learning environments based on curriculum sensitivity allow students to understand the environment better, change their way of thinking about nature and make positive changes related to the environment. The numerical results find slight but still significant disparities in the level of knowledge between age- and gender groups, with 15-year-old boys having a little bit higher knowledge of the environment compared to 12-year-old girls [13]. In all cases, the views toward environmental education are positive and are only slightly affected by individual factors.

This is in line with the past research that showed that location-based learning is so important and attracts learners [14-16]. As regards the domain of knowledge gains. The longer and the more often students have an opportunity to learn in natural settings the better results they have is in line with the effect [17]. Among the many changes observed from the program evaluation are shared learned attitudinal changes seen in other community-based initiatives that focus on sustainability skills [18,19].

Although the aspects of knowledge, attitude and age/gender of the students do not point to strong correlations, this does not imply a lack or weakness of the environmental education's impact, and a deeper analysis of these aspects is thus called for. The sensitivity of these results is very high and thus a call for more statistical analysis and exploration of other cognitive-behavioral factors, which can be the hidden factors based on individual characteristics [20]. Fully describing the mechanisms that turn into ecological worldviews by way of environmental learning requires a holistic approach with mixed research methods that combine surveys with interviews, observations, and other approaches.

However, it is worth remembering that definitive quantitative results remain provisional, and the study's results should be handled with caution. The observed educative impact and direction changes, as positive as they may be, hardly measure the individuals' choices concerning the new behaviors they developed [21]. In my presentation, I noted that several studies show a gap in existing environmental education, where students may become more aware and concerned about the environment, but the positive impact is only limited to such awareness without any significant behavior change [22]. This study is carried out to ensure that qualitative data from educators will lead to a critical perspective on whether and how environmental learning affects students' real-world choices and conduct.

To sum up, these pilot studies prove that environmental education programs that utilize place-based learning may stimulate ecological knowledge and positive attitudes among students. Nevertheless, further study remains necessary to identify the deeper role that such a program brings to mind in students' worldviews and behaviors. A holistic assessment of the aptness of such programs in imparting awareness about sustainability and the effective way of promoting environmental conservation remains an area that needs to be further explored by future researchers.

### Conclusion

This work demonstrated the most distinct part of place-based environmental education in changing students' environmental knowledge, attitude, and behavior. It was revealed that students at the age of 15, in general, had adequate information on environmental issues, although the subjects were not cut and dry. In some cases, the difference was found to be between gender and age. In general, students' reactions to environmental education were positive and neutral; these latter attitudes varied little when described regarding demographic factors. Covering the fact that students are academically on the level and are generally satisfied with their learning, the research nevertheless requires deeper study to reveal layers of different sorts of interactions, which exist within the connection between cognitive, emotional, and behavioral outcomes of the study and student features. Further examinations of the programs will assist in determining the best environmental education pedagogy and development which can bring more real-world transformative effects of values of sustainability thinking. The upbringing of the next generation of eco-citizens starts with an appreciation of how environmental education facilitates the transitions to an ecological point of view and a new person's lifestyle. Overall, environmental assessment can reveal which location-specific strategies work better to create a new generation of people with ecological awareness, responsibility, and activity ability.

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