

Awareness of plastic pollution and adoption of green consumer lifestyles among students from high school

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SUMMARY

Green consumerism is a powerful tool that has the ability to be implemented to reduce plastic pollution. With the ever-increasing issue of plastic pollution, an uptake in green consumer lifestyles is as important as ever. This problem led us to research the question, “how will an increased awareness of worldwide plastic pollution lead to green consumer lifestyles among students who attend High School X?”. With this question, we hypothesized that an increased awareness of plastic pollution will lead to an increased uptake of green consumer habits and lifestyles. We used an experimental method with a pre-test post-test design to test our overarching hypothesis. Participants had to complete two questionnaires a week apart from each other. In addition, participants in the experimental group read and watched material about plastic pollution every day throughout the course of the week. After collecting our data, we assessed whether knowledge about plastic pollution and pro-ecological worldviews were changed significantly according to the New Ecological Paradigm Scale. There was a statistically significant increase in awareness and pro-ecological world views in the experimental group supporting our hypothesis. From our results, we were able to conclude that the material given to the experimental group was successful in increasing individual knowledge regarding plastic pollution as well as increasing individual pro-ecological world views. This increase in knowledge is also expected to increase the uptake of green consumer habits among our participants, therefore accomplishing the goal of our study.

INTRODUCTION

Current research estimates that there is around 5.25 trillion pieces of plastic debris present in the ocean (1). The alarming quantity of plastic within our oceans has elicited worldwide concern regarding the deteriorating state of the environment, which has highlighted the necessity of green consumerism. Green consumerism can be defined as the consciousness of how personal purchases will affect the environment (2). In other words, green consumers tend to purchase products that they feel are beneficial for the environment. For instance, when a green consumer is faced with the decision of purchasing a product derived from recycled materials, compared to

an equivalent product that is not, the green consumer will ideally choose to purchase the product composed of recycled materials.

Auspiciously, within the past few decades, there has been an upsurge in the number of consumers who have adopted green consumer purchasing habits. This rise has been most apparent in young people. In a 2018 questionnaire of U.S. consumers, 48% of respondents disclosed that they are willing to change their consumer habits to reduce their impact on the environment (3). In an additional questionnaire that targeted young people, 72% of respondents stated that they are willing to pay more for products that are environmentally-friendly and that came from companies that are committed to making positive social and environmental changes (4). The difference in the percent of questionnaire respondents that are willing to change their lifestyle to benefit the environment demonstrates how much more the younger generations care about current environmental issues. Furthermore, an additional study concluded that the “greenest” consumers are between 17 and 25 years old (5). Therefore, green consumers are generally thought to be younger and better educated than their non-green counterparts. This illustrated that the younger generations are well-informed about current environmental problems. Now it is vital to aim this environmental concern toward environmental action through green consumerism and education about green consumerism.

An imperative factor that leads to the development of green consumer habits is awareness, more specifically, awareness of the various environmental crises currently afflicting the Earth. Awareness, as defined by Oxford Dictionary, is concern about, and well-informed interest in a particular situation or development (6). But for the purposes of this study, awareness will relate directly to a consumer’s knowledge and concern regarding the prominent environmental problem: plastic pollution. Even through the extensive exploration of consumer awareness and consumer purchasing habits, it is still difficult to quantify how or even why green consumers develop their purchasing habits. To overcome this challenge, U.S. environmental sociologist, Riley Dunlap and his colleagues developed the New Ecological Paradigm Scale (NEP), which is used to measure the environmental concern of groups of people (7).

Recently, green consumerism has become most evident through society’s push back on plastic straws. A viral video in 2018 displayed a turtle that was struggling to breathe because of a plastic straw that got lodged into its nasal cavity (8). The video overtly portrayed the turtle getting the straw removed from its nasal cavity by a wildlife conservationist. This explicit video was eye opening for its viewers because the real-life implications of plastic pollution and littering were displayed.

After viewing the video, it was said that numerous people decided to cut down on their personal plastic use by using reusable metal straws instead of single-use plastic straws (8). This exemplifies just how powerful awareness can be; after viewers became aware of the plastic pollution problem, they decided to make lifestyle changes to better the environment and reduce their personal plastic use. Many other consumers are doing the same and making this switch to sustainable straw alternatives; this has already made an impact on the global straw market. Although straw consumption remains high, there has been a shift in consumer preference from plastic straws to other biodegradable and reusable alternatives (9). This statistic shows the extent of the impact of environmentally-conscious consumers, and how there are already visible changes being made to what consumers purchase on a global scale. The reason for this large push-back on plastic straws is because awareness is relatively high on this particular issue. So, more awareness must be raised on other environmental issues to yield the same results as the plastic to metal straw movement. There is still plenty of hope that this awareness and therefore abandonment of plastic straws will lessen the usage of other plastics. Additionally, straw bans and the move-away from plastic straws is only the first step to the decreased usage of other plastics.

With all of these studies in mind, we have decided to explore the effect of awareness of plastic pollution on green consumer habits using students from High School X. We chose the demographic of high school students combined with the environmental issue of plastic pollution because these two variables have never been explored together. Also, to the best of our knowledge, there is currently no literature about the effect of awareness on green consumer habits using high school students in the United States. We decided to study awareness and green consumerism with high school students because we think it is particularly important for young people to be aware of current environmental issues. By being exposed to the truth about the environment at a young age, this will help to develop morals that young people will carry into their adulthood and eventually teach their own children. Essentially, exposure at a young age will eventually lead to societal awareness, which is essential in fixing the way we live and to help our environment. Ultimately, consumer awareness of environmental issues, like plastic pollution, in addition to awareness of green products is critical in contributing to high green consumer adoption rates. We hope to observe in this study the impact of awareness on the intention to participate in green consumer behaviors under the hypothesis that an increased awareness of plastic pollution will lead to an increased uptake of green consumer habits and lifestyles. There was an increase in awareness and pro-ecological world views in the experimental group that was statistically significant, supporting our hypothesis. From our results, we were able to conclude that the material given to the experimental group was successful in increasing individual knowledge regarding plastic pollution as well as increasing individual pro-ecological world views.

RESULTS

Twenty-six high school-age students from one high school on Long Island participated in the study. Thirteen were randomly selected for the experimental group and the

other thirteen were put into the control group. Participants completed a survey at the beginning of the week and the same survey at the end of that week. In addition to the two surveys, we asked participants in the experimental group to read carefully selected articles from non-biased sources regarding plastic pollution and green consumerism.

After separating the data by question and by group, we removed all the names of the participants from the spreadsheet for the privacy of the participants and ethicality of the study. NEP Scale responses were then converted into numbers one to five, with one indicating a strong disagreement to the statement and five indicating a strong agreement to the statement.

The numbers in the left orange column above are the responses from all the participants in the control group for the first statement of the NEP Scale from the preliminary questionnaire. The second orange column is responses from the same statement on the NEP Scale for the post-study questionnaire by the participants in the control group. The same format was used for the experimental group, which is shown below the orange columns in blue. The numbers within the same row correspond to the same participant. We used a paired sample t-test to compare the data collected from the preliminary and post-study questionnaires. The paired sample t-test for two sample means allowed us to determine if the participants answered the same statement on the NEP Scale differently after being exposed to material regarding plastic pollution. The advantage of using paired t-test is that we were able to measure individuals' changes and not just changes for the group as a whole.

Along with the statements from the NEP scale, all participants had to indicate how much they believed that they knew about the current plastic pollution crisis on a 10-point

Table 1: Survey results

Control Group			t-Test: Paired Two Sample for Means	
	5	5		
	7	6		
	8	8		
	4	8		
	7	8	Mean	6.615385 7.153846
	5	4	Variance	3.923077 2.807692
	7	8	Observations	13 13
	3	6	Pearson Correlation	0.697259
	8	8	Hypothesized Mean Difference	0
	7	7	df	12
	6	6	t Stat	-1.33891
	10	10	P(T<=t) one-tail	0.102706 Not SS
	9	9	t Critical one-tail	1.782288
Averages	6.615	7.154		
Standard Deviation	1.980676	1.675617		0.538

Experimental			t-Test: Paired Two Sample for Means	
	5	7		
	1	8		
	5	9		
	6	8	Mean	5.692308 8
	8	9	Variance	4.064103 2
	7	9	Observations	13 13
	4	8	Pearson Correlation	0.409213
	6	5	Hypothesized Mean Difference	0
	7	9	Df	12
	5	6	t Stat	-4.30775
	8	9	P(T<=t) one-tail	0.000509 SS
	8	10	t Critical one-tail	1.782288
	4	7		
Averages	5.692	8.000		
Standard Deviation	2.015962	1.4142		

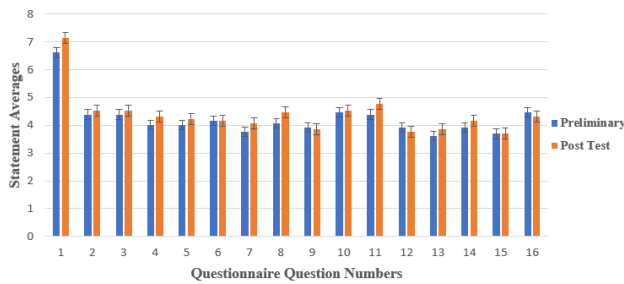


Figure 1: Control group mean questionnaire averages of NEP Scale scores per question preliminary and post-study with standard error bars.

Likert Scale. Participants were asked this same question on both questionnaires, so we were able to use a paired sample t-test to determine if there is a statistically significant difference of knowledge regarding plastic pollution from the preliminary to post-study questionnaires. Awareness of plastic pollution remained about the same within the control group with the mean Likert Scale responses having a difference of only 0.538 and a p -value of 0.1027, which is statistically insignificant, especially considering that the Likert Scale used was only composed of whole numbers. Additionally, responses from the NEP Scale remained about the same with an average difference of 0.1298 for all 15 NEP Scale statements. The largest average difference between control group participant responses was 0.3846 and the smallest difference was 0. This data demonstrates that most participants did not even turn out to change their NEP Scale response by one point on the Likert Scale. Therefore, we failed to reject our null hypothesis for the control group. The sample mean t-test allowed us to accept both null hypotheses for the control group. Additionally, the p -value resulting from the paired sample t-test performed on the control group was 0.1027, which is greater than the α -value of 0.05. Therefore, there is no statistically significant difference between the knowledge of the control group regarding plastic pollution from before and after the study (Figure 1). This was expected, as the control group did not read any material to increase their personal knowledge about the topic being studied. On the contrary, the p -value resulting from the paired sample t-test performed on the experimental group is 0.0005, which is less than the α -value of 0.05. Thus, the increase in participants' knowledge regarding plastic pollution in the experimental group was statistically significant from before and after the study (Figure 2). Therefore, the material that the participants were exposed to throughout the duration of the study was successful in increasing participants' knowledge about plastic pollution.

In agreement with the p -value resulting from the measurement of individual awareness of plastic pollution within the experimental group, there was a statistically significant difference between many of the NEP Scale statements. While only 7 of the NEP Scale statements resulted in statistically significant p -values, all statements still reared differences between 0.1546 and 1.0769, signifying that some questions may have been affected more than others from the increase in knowledge about plastic pollution. Regardless, on average, numerical responses to the statements included

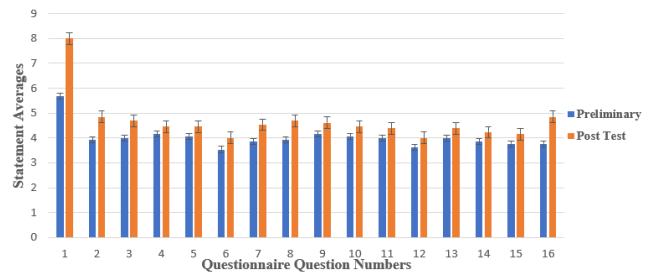


Figure 2: Experimental group mean questionnaire averages of NEP Scale scores per question preliminary and post-study with standard error bars.

in the NEP Scale increased, signifying that individual pro-ecological world view increased. Participants also had to state at the end of the final questionnaire if they are planning to adapt any of the green consumer habits that they learned throughout the experiment. There was a 100% response rate of yes, along with individual examples of what specific habits the participants planned on acquiring. These habits included recycling, using reusable bags, reusable water bottles, etc. From these overwhelming positive results, we can conclude that despite not being exposed to the material meant to increase awareness of worldwide plastic pollution, outside factors could have influenced the participants to cause the 100% "yes" response.

DISCUSSION

Our findings conclude that the materials given to the experimental group participants were successful in increasing awareness and knowledge regarding worldwide plastic pollution. In addition, the increased knowledge from the materials given to the participants was shown to make the participants intend to adopt more or any green consumer habits. These results support our overarching hypothesis that increased awareness of plastic pollution will lead to green consumer habits. The results from this study can be valuable in determining the best way to get more individuals to take up green consumer habits.

On the other hand, our data shows no statistically significant results for nine of the statements from the NEP scale. This could be due to the relation between the material given and the particular statement on the NEP scale. To account for this, we suggest that other researchers try to find articles and videos that have been shown through other studies to change NEP Scale statement responses. This could also be due to the relatively short duration of our study. Future researchers could increase the duration of the study to see if time affects awareness and questionnaire responses. We decided against a long-term study in hopes of increasing sample size and due to the time constraints associated with our project. The mixed results from the experimental group portrayed how more research needs to be done to determine if the statistically significant results were false positives, or if the non-statistically significant results were false negatives. Additionally, since only one of the 15 NEP Scale statement responses changed statistically significantly in the control group, we believe that there was no outside event that occurred during the course of the study to increase plastic

pollution awareness enough to skew the results of our study (Figure 3).

There were several limitations surrounding the questionnaires used in our experimental method with a pre-test post-test design. The “experimenter demand effect (EDE)”, as defined by Mummolo and Peterson from Stanford University, is “bias stemming from participants inferring the purpose of an experiment and responding so as to help confirm a researcher’s hypothesis” (10). The statistically significant difference in the response to the statement from the NEP scale, “Present generations of humans have NO moral duties and obligations to future human generations” (7), by the control group could be accounted for by the experimenter demand effect because participants could have been attempting to skew our results to give us the results we hypothesized for the experimental group, rather than their personal opinion. We attempted to account for the experimenter demand effect when creating the questionnaire. Directly before the first question on the questionnaire we put the phrase, “Carefully read the questions below, and truthfully answer all questions based on you and your own knowledge,” to ensure our participants that we were exclusively collecting data on their opinions and that we were not looking for them to answer the statements and questions in a specific way.

Additionally, there is a gap between what people intend to do and their actions. Even though awareness of plastic pollution was shown to have increased among the experimental group participants, and they responded with new habits that they intend to take up after participating in our study, there is no way to accurately determine the success rate of these new habits among the participants. Due to the time constraints, we were unable to perform a follow-up questionnaire in an attempt to see the actual uptake of green consumer habits. We attempted to account for this limitation by having participants state specific green consumer habits that they intend to carry out and adopt into their life after this study. This helps to account for this limitation because it prevented participants from just answering yes or no; the participants actually had to put thought and effort into answering the question.

An additional limitation to our study could be the sample size. We ended up getting only 26 participants which was far below the number we were hoping for. We also were only able to sample students from our high school in our particular geographical region. This also may have impacted the results of our study because we were not able to collect data from students in high schools in other parts of the world where their views have the possibility of being different than those of students who attend our high school. These limitations in addition to the other limitations previously mentioned could have skewed the results of our study as it is difficult to generalize our results to the general population of high school students across the world.

Finally, now that it has been established that increased awareness and increased scores on the NEP Scale lead to an intent to take up green consumer habits, future researchers should conduct research to determine the most effective material to increase green consumer habits among all age groups and not just high school students. Determining this would help make for a more sustainable world, and an overall better planet. As plastic use is only becoming more detrimental to the environment, further research regarding this topic is only increasing in importance.

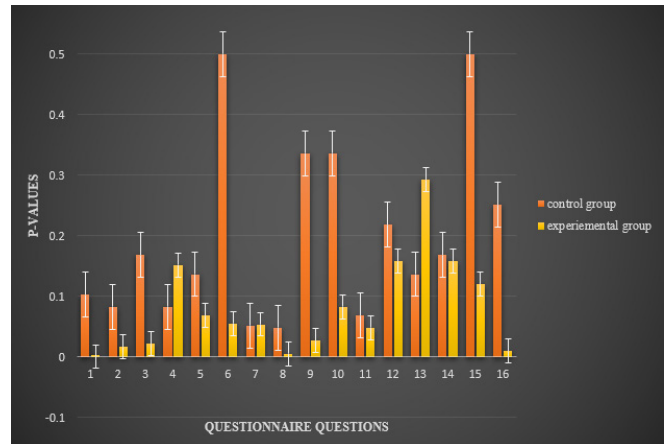


Figure 3: Comparison of p-values between the control and experimental groups by questionnaire question.

MATERIALS AND METHODS

The method used in this study was an experimental approach with a pre-test post-test design. An experimental method was used so we could compare the results of the questionnaire from before commencing the study, to the one after through the utilization of a statistical analysis of the NEP Scale, as well as additional questions included in the questionnaires. In addition, other studies that utilized the NEP Scale used an experimental method as well.

We recruited 26 participants from a singular high school on Long Island to participate in this study. This demographic included a mixture of males and females and ages ranging from 13 to 18 years old.

Before starting the experiment, we received permission from an Institutional Review Board because the study involved human subjects. After our study was approved by the review board, we obtained a list of all the students in High School X. We did this so we could later assign a number to each student, who was willing to participate and divide the students randomly into the control and experimental groups. After assigning every student in High School X a number 1 to 720 using Excel, we utilized a systematic sampling method to randomly select students to participate in the study.

We then proceeded to contact the selected students via their school email address, asking them to participate in the study. In the same email, we explicitly explained how our experiment would work and outlined everything the student would need to do to be a successful participant. We sent a different email to those chosen to be in the experimental group than the students in the control group, but the preliminary and post-study questionnaires were the same for both groups. The students in the control group were only sent information about the study, followed by instructions to complete the pre-test questionnaire, then a week later to complete the post-test questionnaire. The experimental students were sent an email with instruction to complete the preliminary questionnaire via Microsoft Forms. Then, they were instructed to read a passage or watch a short video clip every day for a week. After the week is over, they completed the post-study questionnaire.

Links to video clips and excerpts from articles were outlined in a day-by-day order in the email that we sent to participants that were part of the experimental group. The

first passage was about the Great Pacific Garbage Patch, which is a result of plastic pollution. The article and graphics were created by The Ocean Clean Up Organization, which was created in an attempt to solve the oceanic plastic pollution problem. The organization is made up of engineers, researchers, and scientists who work to inform the public about plastic pollution as well as trying to clean up the plastic in the ocean. The second article explained what green consumerism is, why green consumerism is important, and ways to adopt green consumer habits. This information came from a website that raises awareness about environmental problems as well as green consumerism. The third passage came from Green Peace and explained the impact of plastic pollution on marine wildlife. The fourth day, participants had to watch a video about sustainability. The video explained the definition of sustainability and the importance of sustainability in protecting the Earth's natural resources. For the last day of the study we had the participants watch another video about the harmful impacts of single-use plastic. All of the material we utilized in the study is strictly facts. We did not intend to try to sway the opinions of participants, rather we intended to observe what they would do with the information given to them.

The questionnaire also included the NEP Scale. Respondents were asked to indicate the strength of their agreement or disagreement with each statement. These responses were then used to construct various statistical measures of environmental concern and to draw conclusions. The NEP Scale is considered to be a measure of a person's environmental world view (4). We made use of the NEP Scale when analyzing the change in participants' attitudes after becoming more aware of the plastic pollution crisis from the material they were exposed to over the course of a week.

After the study's completion, the data collected from participants was put into Excel to perform a paired sample t-test to determine the statistical significance of the data collected.

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