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Influence of Climate Change on High School Students' Attitudes Towards Electric Vehicles

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ABSTRACT

Electric vehicles are gaining interest due to their increasing affordability, improved design, and longer range. Generation Z buyers currently comprise a small percentage of new electric vehicle purchases, but will dominate as the largest consumer group in the automotive industry during the next 10-20 years. To test the level of interest in electric vehicles by the high school subset of Generation Z, 56 anonymous individuals were surveyed to solicit their opinions. The survey asked for each participant's opinion on climate change and electric vehicles in an attempt to find a correlation between a person's attitude towards climate change and that person's interest in electric vehicles. I hypothesized there would be a positive correlation between a student's view on climate change and their perception of electric vehicles. Using a Pearson's correlation study, a positive, but weak, correlation was found between the two topics. Based on the data's *p* value, the correlation was determined to be statistically insignificant, rejecting my original hypothesis. Through an exploratory data analysis of the survey results, it was found that most high school students are aware of climate change, but their awareness alone may not influence their lifestyle choices to lessen the problem. I found that the respondents were more concerned about the price of electric vehicles than their environmental benefits. Despite observing a weak correlation, this study indicated that if price were not a factor, purchasing an electric vehicle would be more strongly considered by those who care about climate change than those who do not.

Introduction

In recent years, the negative effects of climate change have become more significant to our youth's future. Serious environmental issues have risen in the past 30 years due to an increase in the use of fossil fuels across the globe (Revkin, 2018). Around 75% of CO_2[1] pollution is emitted from internal combustion engine vehicles (ICEV[2]) (Brinson, 2020). Despite this, the convenience and affordability of ICEVs have led to over one billion of these cars being produced around the world. To address this problem, auto manufacturers started making electric vehicles (EV), which are made with no combustion engine and, therefore, have zero emissions. In the past, electric vehicles were costly and had limited range, causing many to have a negative impression of them. However, Tesla Motors was able to successfully combine the practicality of an ICEV with the sustainability of

[1] Carbon Dioxide, or CO_2, is a greenhouse gas that can be produced by the release of fossil fuels into the atmosphere. It is a large contributor to the destruction of the ozone layer. In addition, studies have shown that CO_2 can be harmful to humans when a high concentration is inhaled (Canadian Centre for Occupational Health and Safety, 2017).

[2] ICEVs are the most common type of vehicles in the United States. They include vehicles that are powered by gasoline, natural gas, diesel, etc. Plug-in hybrid vehicles are also included in ICEVs (Office of Energy Efficiency & Renewable Energy, 2013).

an electric vehicle in its prototype of the Tesla Roadster in 2003. After this innovation, traditional ICEV manufacturers such as Nissan, Chevrolet, and Volkswagen began introducing their own lines of EVs (Valdes-Dapena & Sherman, 2019).

EVs are not the be-all and end-all solution to climate change problems, however they do provide a step in the right direction. EVs, however, could raise other potential environmental harms, such as those caused by the destructive mining process for procuring raw materials used in making lithium batteries and recycling those batteries at the end of their lifespan. More research is needed to understand how the harms to the environment weigh against the benefits of using EVs. Currently, Tesla Motors is researching a less costly, in terms of both price and environmental impact, way to create batteries for EVs. This information is useful for the marketing of EVs, as it could be a selling point for people who care about climate change. There are several other attributes that attract consumers to purchase EVs. With the faster acceleration of an electric motor, the stylish exterior and modern features, a quiet ride, and no need for visits to gas stations, EVs appeal to technologically savvy and socially-conscious drivers. In addition, policy incentives (i.e. tax rebates[3]) or perks from the Clean Air Vehicle Decal Program (i.e. driving in HOV lanes[4]) are also incentives for purchasing EVs (Liao, 2016).

As of 2019, electric vehicles account for 1 in 40 new car purchases in the United States (Kane, 2020). This is a huge improvement from the negligible number of EVs sold prior to 2011 (Edison Electric Institute, 2018). Recent surveys show that people between the ages of 24 and 64 account for about 68% of these purchases and people above the age of 64 account for about 32%. This means that fewer than 1% of the purchases of EVs are made by Generation Z consumers (Hedges & Company, 2020). There could be several reasons for this. First, people in this generation tend to buy used vehicles over new ones; or, they prefer a different mode of transportation such as public transportation (e.g., buses, trains, subways) or ride-sharing services (e.g., Uber or Lyft). The second significant issue is that electric vehicles are perceived to be too expensive to purchase and maintain. These issues are understandable for a person who is a new driver or is currently enrolled in a high school or college. Also, driving might not be a priority for most people in this age bracket. However, driving will most likely become a priority to this group in the future and, thus, they may need their own vehicle to use. In the next 10 to 20 years, Generation Z will account for around half of the purchases of new vehicles (Hedges & Company, 2020). Moreover, their choice in vehicles will make a huge impact on the future of climate change. For this reason, I asked "Does a high school student's view on climate change influence their likelihood of purchasing an electric vehicle?" To answer this question, I used a survey to gather 56 high school students' opinions. Through a correlational method and an exploratory data analysis, I was able to find the relationships among these variables. I hypothesized the results would show a positive correlation between a student's view on climate change and their perception of electric vehicles. I further expect the results to reinforce the notion that Generation Z is more passionate about climate change and will have a greater influence on the future of the Earth's environmental sustainability. However, I recognize that EV manufacturers such as Tesla Motors have become "trendy" and labeled as luxury vehicles, so I expect some interest in EVs could be due to reasons unrelated to environmental concerns.

Literature Review

Low Adoption Rate of Electric Vehicles

[3] In the United States, the government rewarded most all-electric car purchasers after 2009 a federal income tax credit of up to $7,500 (Fuel Economy, 2020).

[4] The Clean Air Vehicle Decal Program permits vehicles to use the High Occupancy Vehicles (HOV) or car-pool lanes, regardless of passenger number in some states (Department of Motor Vehicles, 2020).

Electric vehicles have been around for years. However, they have only started gaining significant popularity in the past ten years. Despite their increase in popularity, there is still only a relatively low percentage of EV drivers across the world. Research by John Thogersen and Jonas V. Ebsen (2019) investigates the explanation for the low adoption rate of electric vehicles in Denmark. This study uses a mixed-method approach including surveys and interviews to understand the subjects' attitudes towards EVs. A positive correlation was identified between the perceived difficulty in using the vehicle, attitude towards EVs, moral obligation to purchase an EV, and the intention of car owners to buy an EV. It was found that personal experience with EVs led to a better perception of the cars (Thogersen & Ebsen, 2019). Other influences on purchasing an EV, including social influence, marketing, and word-of-mouth communication, are significant factors in the discussion. Moreover, in order to increase demand for EVs, the negative perception surrounding the cars must be reduced. From Thogersen and Ebsen's study, I adopted the theoretical framework by using a study of the psychological attitude of individuals for my survey. Considering that the subject group of my study included non-drivers, my study was designed to test the perception of EVs without requiring the participant to have driven or ridden in one.

Perceived Satisfaction and Efficiency of Electric Vehicles

Despite the low acceptance of EVs, there is still a bright future for these cars (Ajanovic, 2015). One study in Germany tested whether interacting with electric cars increased both drivers' perceived efficiency and perceived satisfaction with them (Wolff & Madlener, 2019). The commercial drivers at German postal delivery service, Deutsche Post, were given the option to drive EVs and ICEVs for approximately three years. It was found that more than 70% of the participants preferred the EVs and that the age of the drivers did not affect the results. Although there was no statistically significant association found between the drivers' ages and satisfaction with EVs, this finding still goes against the largely believed assumption that older people are less likely to adapt to electric vehicles. A different study that examined the level of acceptance of EVs, but with a focus on gender and age, showed that older participants had a higher level of acceptance than younger participants, possibly due to their "higher environmental consciousness" (Ziefle et al., 2014). However, the "younger" participants called into question were all above the age of 18.

In my study, I surveyed people 18 years old and younger because existing research reveals that the older generations are not the cause for the low adoption rate of EVs. Thus, I wanted to survey how high school students felt about EVs to try and understand the mindset of this cohort of the younger generation. While my study did not require participants to physically interact with an EV, unlike Wolff and Madlener's study, I incorporated the 5-point Likert Scale they used to find the participants' perceived interest in EVs.

Environmental Influences on Electric Vehicles

In an attempt to understand the possible future of EVs, researchers predict how drivers of ICEVs will perceive the government of the United Kingdom's (UK) decision to ban the sale of non-electric vehicles in 2040 (Bennett & Vijaygopal, 2018). Five factors were used to analyze the public's reception to the ban: "level of environmental concern, attitude towards electric cars, belief about the importance of air pollution, driving requirements, and reaction to the cost of the ban to the individual." It was found that environmental concern did not affect the attitudes of the non-EV owners' perceptions of EVs. Two of the factors, "level of environmental concern" and "attitude towards electric cars," were the main factors used in my study. Since my subjects included non-drivers and new drivers, they presumably have little preexisting bias due to their inexperience using ICEVs, as opposed to the possibly biased ICEV drivers in the UK in Bennet and Vijaygopal's study.

How Climate Change Affects the Youth

Climate change is an important issue to the young people of Generation Z. A study conducted by Amnesty International[5] found that in its survey taken by 10,000 participants within Generation Z, 41% responded that "climate change was one of the most important issues facing the world" (Amnesty International, 2019). Another 36% ranked "air pollution" as the most important issue. Thus, a total of 77% of the respondents ranked these related topics to be the most important issues that society is facing today. The participants ranked both of these topics as the number one issue over other topics like terrorism and deforestation. This survey revealed the level of seriousness of climate change to the members of Generation Z across the world. For my own survey, I surveyed participants between the ages of 14-18 about climate change to understand both their awareness of the subject and whether they would be more inclined to purchase an EV due to such awareness.

Electric Vehicles, Climate Change, and Generation Z

In summary, the studies regarding EVs only demonstrated the general acceptance of EVs among drivers, but none address the acceptance of EVs among new drivers or non-drivers in Generation Z. This generation of people may be the most important population to adopt electric vehicles as we consider the future of climate change. Studies show that if society as a whole does not reduce its carbon emissions in the near future, then the Earth will face irreversible damage (United Nations, 2019). Finding an answer to this query is important because it could help us understand what might motivate current and future buyers of electric vehicles. This gap in the research is addressed in this study by attempting to determine whether a high school student's concern over climate change issues correlates with the student's perception of an EV.

Methodology

In an attempt to understand a relationship between an individual's views regarding climate change and their perception of electric vehicles, a correlational method was used for this study. Although correlational research cannot determine a cause-and-effect relationship, it provides a general direction of the connection between the two topics. To get a deeper understanding of what the data means, an exploratory data analysis was used to determine smaller relationships between the survey questions and explain trends.

Survey Design

To begin, a survey issued through Google Forms was used to collect the necessary data. The survey was posted on social media (via Instagram and Facebook) in order to reach as large of an audience as possible. In total, it was taken by 56 individuals between the ages 14-18. I initially intended on surveying a larger age group, however I found the results would be more precise by narrowing it down to only high school students. The data from this survey was used to determine the correlation between high school students' views on climate change and their likelihood of purchasing an electric vehicle.

Within the survey, ten statements were presented, each followed by a response to be answered on a 5-point Likert scale. Each statement read an opinion regarding either climate change or electric vehicles. Following each statement, the respondents were prompted to choose an answer between "1," meaning they strongly disagree with the statement, and "5," meaning they strongly agree with the statement. All statements and responses were on a 5-point Likert scale in order to be compared later in the correlation test. Relative to the statements in the survey, the closer the response is to "1," the less they care about climate change or like electric

[5] Amnesty International is a global organization with over 7 million members across the globe. Their goal is to fight injustice and protect human rights.

vehicles. The closer the response is to "5," the more they care about climate change or like electric vehicles. Table 1.1 shows the five statements in the survey regarding climate change and their respective identifiers (ID) that will be used in tables throughout this paper. Table 1.2 shows the five statements in the survey regarding electric vehicles and their identifiers. The full survey as seen by the participants is shown in Appendix A.

Table 1.1. Climate Change Statements

ID	Statement
CC. 1	You believe that climate change is a real issue.
CC. 2	Climate change and global warming are issues you personally care about.
CC. 3	You are actively aware of your carbon footprint and make lifestyle choices to minimize it. (Carbon footprint means the amount of carbon dioxide you emit due to consumption of fossil fuels).
CC. 4	Climate change should be a highly prioritized issue in politics.
CC. 5	If no action is taken, global temperature will rise in the next 30 years due to man-made causes.

Note. "CC" stands for "climate change." Climate change statements were not numbered on the actual survey. The identifiers were added later to organize the data.

Table 1.2. Electric Vehicle Statements

ID	Statement
EV. 1	You think electric vehicles are beneficial to society.
EV. 2	It is worth paying a premium for an electric vehicle.
EV. 3	If there was no difference in the purchase price of the vehicles, you would rather purchase an electric vehicle than an internal combustion engine vehicle (conventional gas car).
EV. 4	You already own an electric vehicle or plan on purchasing one in the future.
EV. 5	Electric vehicles have better acceleration, are quieter, and are overall more advanced than most internal combustion engine vehicles (conventional gas cars).

Note. "EV" stands for "electric vehicle." Electric vehicle statements were also not numbered on the actual survey. The identifiers were added to organize the data.

Data Collection

The data was directly transferred from Google Forms to Google Sheets, a program that automatically transfers and organizes the data directly from the survey to a spreadsheet. The data was then manually separated into two categories, climate change and electric vehicles. For each category, a table was created to organize the participant number by rows and the five statements by columns. For each participant, the two sets of five statements

were averaged and used as that participant's coordinates. The average of the five responses from the climate change statements was used as that participant's X-coordinate. The average of the five responses from the electric vehicle statements was used as that participant's Y-coordinate. Then, using the created coordinates, a point was placed on a scatter plot for each of the 56 participants. The coordinates were the numerical values compared in the correlation study.

Data Analysis

Using a Pearson's Correlation test, a Pearson's correlation coefficient (*r* value) was calculated to find the strength of the correlation between the two topics. The Pearson's correlation coefficient is essentially the linear slope of the best fit line in the scatter plot. Visually, if this line produces a positive slope, then there is a positive correlation between the two variables. On the other hand, if the line produces a negative slope, then there is a negative correlation. If the points on the graph are too scattered to draw a determinable line, then there is no correlation. Figure 1 illustrates the scatterplots for these concepts. This correlation test also determined the strength of the correlation. The closer the *r* value is to +1 or -1, the stronger the correlation. The closer the *r* value is to 0, the weaker the correlation. In addition, a *p* value was also calculated at the significance level of 0.05 in order to find the overall significance of the correlation found by the *r* value.

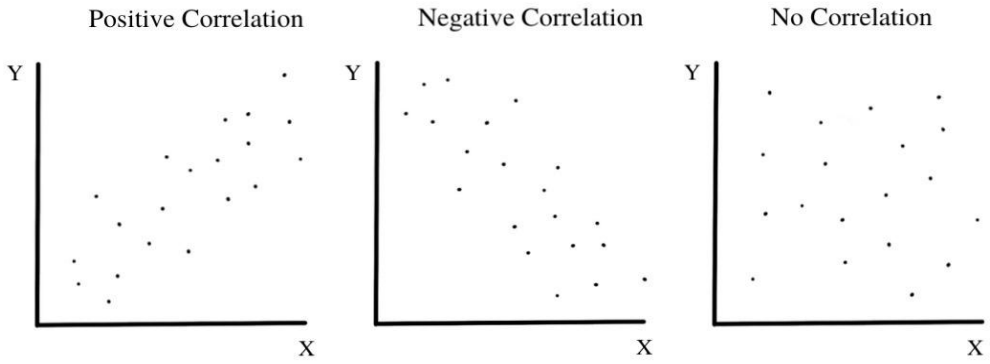


Figure 1. Different Correlation Scatter Plots

Note. This image depicts examples of scatter plots with their respective correlation.

For a deeper analysis, an average of the 56 responses for each individual statement was calculated to understand different trends in the data. The averages were used for two of the statements from both the climate change and electric vehicle categories. From the climate change category, the first and third statement, CC.1 and CC.3, were compared to find the relationship between a high school student's belief in climate change and their lifestyle choices to minimize their environmental impact. From the electric vehicle category, the second and third statement, EV.2 and EV.3, were compared to find the relationship between a high school student's perceived worth of an electric vehicle and the cost of an electric vehicle. These two subanalyses were displayed in area and stepped area charts to visualize their relationships. Individual statements, like CC.4, EV.1, and EV.4, were each analyzed independently to understand smaller trends in data to help prove or disprove assumptions made earlier.

Results/Findings

The survey results from the 56 participants described in the methodology will be shared below. Table 2 shows the raw data of the responses of the first ten participants.

Table 2. Climate Change and Electric Vehicle Survey Sample

Participant #	CC Q.1	CC Q.2	CC Q.3	CC Q.4	CC Q.5	EV Q.1	EV Q.2	EV Q.3	EV Q.4	EV Q.5
1	5	4	5	4	5	4	3	4	5	3
2	5	5	3	4	5	3	3	3	3	3
3	5	5	3	5	5	3	4	5	4	4
4	5	3	2	3	4	3	3	4	1	3
5	5	4	3	4	4	4	3	5	4	3
6	5	4	3	5	5	5	5	5	3	3
7	5	5	5	5	5	4	3	5	4	3
8	4	4	3	4	5	4	4	5	5	5
9	4	3	1	4	3	4	3	4	4	4
10	5	5	4	5	5	3	3	4	2	3

Note. This table represents the responses from the survey of the first ten participants. As a reminder, "CC" represents "climate change" and "EV" represents "electric vehicle." To avoid redundancy, the full raw data for the 56 respondents will not be included in this research paper. See Appendix B for the full set of organized data.

This data was then split into their respective categories and an average was taken of each participant's response per category, as shown in Table 3.1 for climate change and in Table 3.2 for electric vehicles. See Appendix B for the full version of the organized data.

Table 3.1. Climate Change Survey Extracted Sample

Participant #	CC Q.1	CC Q.2	CC Q.3	CC Q.4	CC Q.5	AVG. X
1	5	4	5	4	5	4.6
2	5	5	3	4	5	4.4
3	5	5	3	5	5	4.6
4	5	3	2	3	4	3.4
5	5	4	3	4	4	4
6	5	4	3	5	5	4.4
7	5	5	5	5	5	5
8	4	4	3	4	5	4
9	4	3	1	4	3	3
10	5	5	4	5	5	4.8

Note. This table is a sample that represents the first ten responses regarding climate change. The average of each participant's response is shown at the end of each row.

Table 3.2. Electric Vehicle Survey Extracted Sample

Participant #	EV Q.1	EV Q.2	EV Q.3	EV Q.4	EV Q.5	AVG. Y
1	4	3	4	5	3	3.8
2	3	3	3	3	3	3
3	3	4	5	4	4	4
4	3	3	4	1	3	2.8
5	4	3	5	4	3	3.8
6	5	5	5	3	3	4.2
7	4	3	5	4	3	3.8
8	4	4	5	5	5	4.6
9	4	3	4	4	4	3.8
10	3	3	4	2	3	3

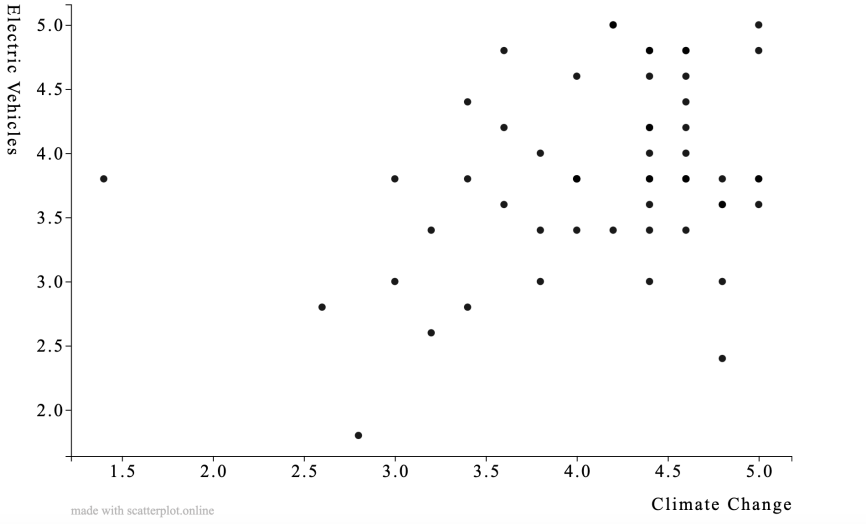
Note. This table is a sample that represents the first ten responses regarding electric vehicles. The average of each participant's response is shown at the end of each row.

The Average X and Average Y were paired together for each participant to create the coordinates, as seen in Table 4.1. Lastly, the coordinates were graphed on the scatter plot shown in Graph 1.

Table 4.1. Participant Coordinates Sample

Participant #	AVG. X	AVG. Y	(AVG. X, AVG. Y)
1	4.6	3.8	(4.6, 3.8)
2	4.4	3	(4.4, 3)
3	4.6	4	(4.6, 4)
4	3.4	2.8	(3.4, 2.8)
5	4	3.8	(4, 3.8)
6	4.4	4.2	(4.4, 4.2)
7	5	3.8	(5, 3.8)
8	4	4.6	(4, 4.6)
9	3	3.8	(3, 3.8)
10	4.8	3	(4.8, 3)

Note. This is a sample of the X-coordinates and Y-coordinates for the first ten participants.



Graph 1. Climate Change versus Perception of Electric Vehicles

Note. Each point represents one of the 56 participant's coordinates on the scatter plot.

The averages of each statement in the climate change category can be seen in Table 5.1. The average of all the responses in the climate change category is 4.14. The averages of each statement in the electric vehicle category are shown in Table 5.2. The average of all the responses in the electric vehicle category is 3.84.

Table 5.1. Climate Change Statements Average

ID	Statement	AVG.
CC.1	You believe that climate change is a real issue.	4.66
CC.2	Climate change and global warming are issues you personally care about.	4.02
CC.3	You are actively aware of your carbon footprint and make lifestyle choices to minimize it. (Carbon footprint means the amount of carbon dioxide you emit due to consumption of fossil fuels).	3.25
CC.4	Climate change should be a highly prioritized issue in politics.	4.21
CC.5	If no action is taken, global temperature will rise in the next 30 years due to man-made causes.	4.53

Note. The statements were included in this table as a reminder as to what each average represents.

Table 5.2. Electric Vehicle Statements Average

ID	Statement	AVG.
EV.1	You think electric vehicles are beneficial to society.	3.89
EV.2	It is worth paying a premium for an electric vehicle.	3.50
EV.3	If there was no difference in the purchase price of the vehicles, you would rather purchase an electric vehicle than an internal combustion engine vehicle (conventional gas car).	4.46

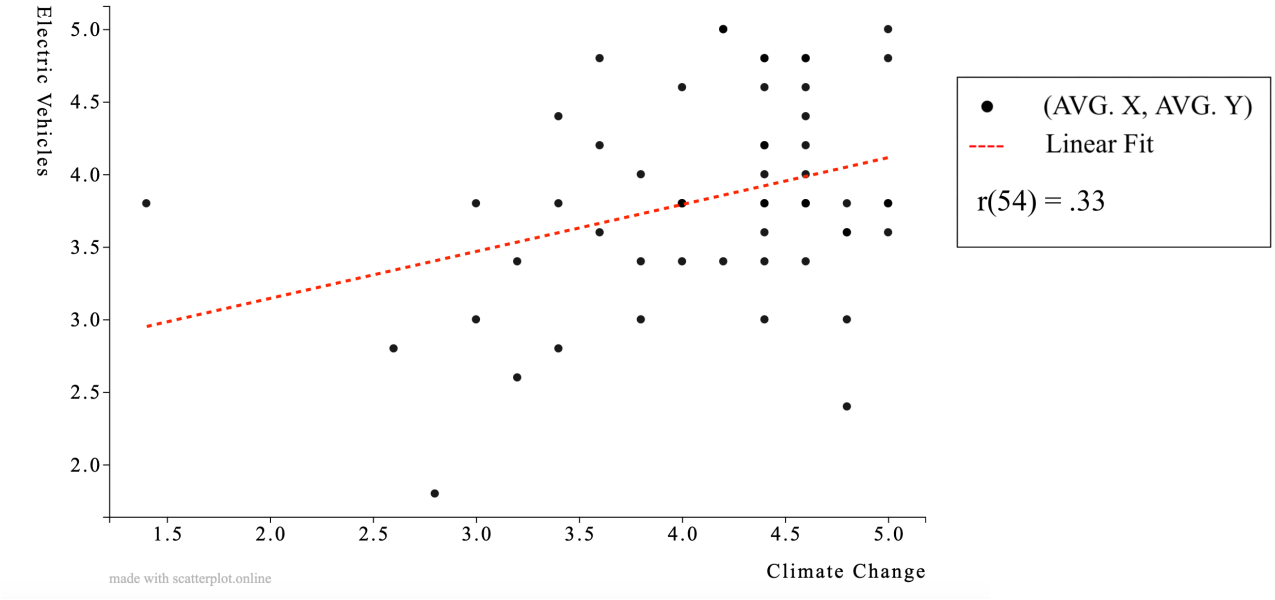
EV.4	You already own an electric vehicle or plan on purchasing one in the future.	3.59
EV.5	Electric vehicles have better acceleration, are quieter, and are overall more advanced than most internal combustion engine vehicles (conventional gas cars).	3.75

Note. The statements were included in this table as a reminder as to what each average represents.

Discussion

Analysis

A best fit line was calculated and drawn onto Graph 1 to find the correlation between an individual's views regarding climate change and that individual's perception of electric vehicles. The slope of this line, or the *r* value, was calculated to be .33. Technically, because the value is greater than 0, there is a positive correlation between people's opinions on climate change and an interest in electric vehicles. However, the correlation is weak since the number is closer to 0 than to +1. In Graph 2, the dotted red line depicts the line of best fit on the scatter plot shown in Graph 1.



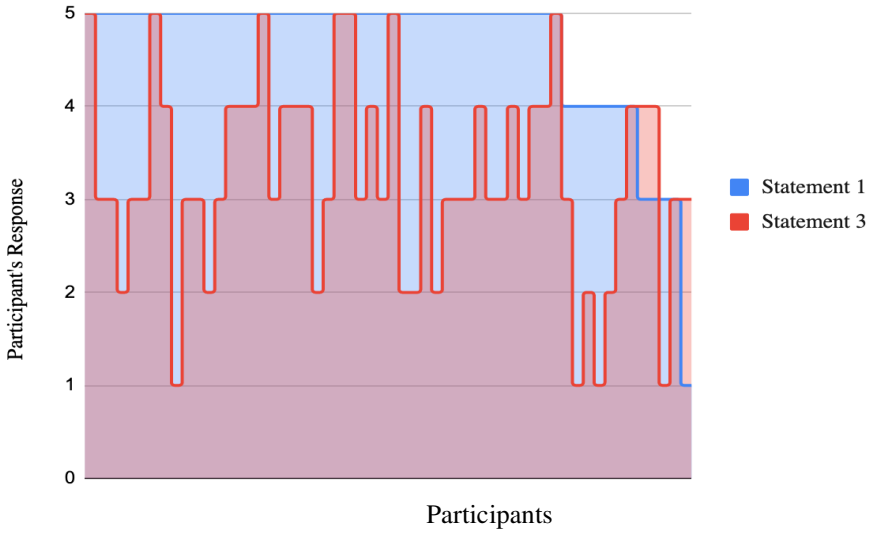
Graph 2. Views on Climate Change versus Perception of Electric Vehicles w/ Best Fit Line

Note. This scatter plot shows the 56 participants' responses comparing climate change and electric vehicles. The best fit line is shown as a dotted red line. The slope of this line is equal to .3295. The "54" in the key is the degree of freedom for the *r* value.

As the correlation test found, there is a positive correlation between interest in climate change and electric vehicles, however, it is weak, (r(54) = .33, p = .013). My original hypothesis was that there would be a positive correlation, but I expected it to be somewhat stronger. This implies that among high school students, their view on climate change does not play a significant role in their level of interest in electric vehicles. In addition, the *p* value was calculated to be .013, which shows that the data is not statistically significant. This confirms that the original hypothesis should be rejected. However, this does not nullify further evaluation.

Subanalysis

The overall average response for all statements in the climate change category was 4.14. It can be inferred that on average, the respondents tend to care about and acknowledge climate change. The first statement presented to the participant in the climate change section, CC.1, was the most general statement. This statement, which reads "You believe that climate change is a real issue," received an average response of 4.66. This was the highest average response of all ten statements. In my assumptions, I stated that Generation Z is very aware of climate change because it will affect this population the most in the future. However, being aware did not equate to being proactive. Four of the five statements regarding climate change had an average response of above four, showing that the respondents mostly agreed with each of these four statements. One statement, CC.3, was an outlier with an average response of 3.25. The four statements with similar responses were strictly looking for the respondents' opinions on climate change, whereas CC.3 prompted the participants to recall if they are actively aware of their carbon footprint and if they make certain lifestyle choices to minimize it. Graph 3 below records the responses for CC.1 in blue and CC.3, "You are actively aware of your carbon footprint and make lifestyle choices to minimize it" in red. The graph shows that a large percentage, specifically 78%, of the participants responded with the highest score of 5 for CC.1, labeled "Statement 1" in blue. In addition, CC.3, labeled "Statement 3" shown in red in Graph 3, received less consistent opinions and the response values were mostly dispersed amongst 3, 4, and 5. This is relevant to the study because it shows that although this generation is aware of climate change, the awareness alone may not influence a person to make lifestyle choices to lessen the problem. Therefore, this relationship will be considered as one of the forces that led to the weak correlation between attitudes about climate change and interest level in electric vehicles.

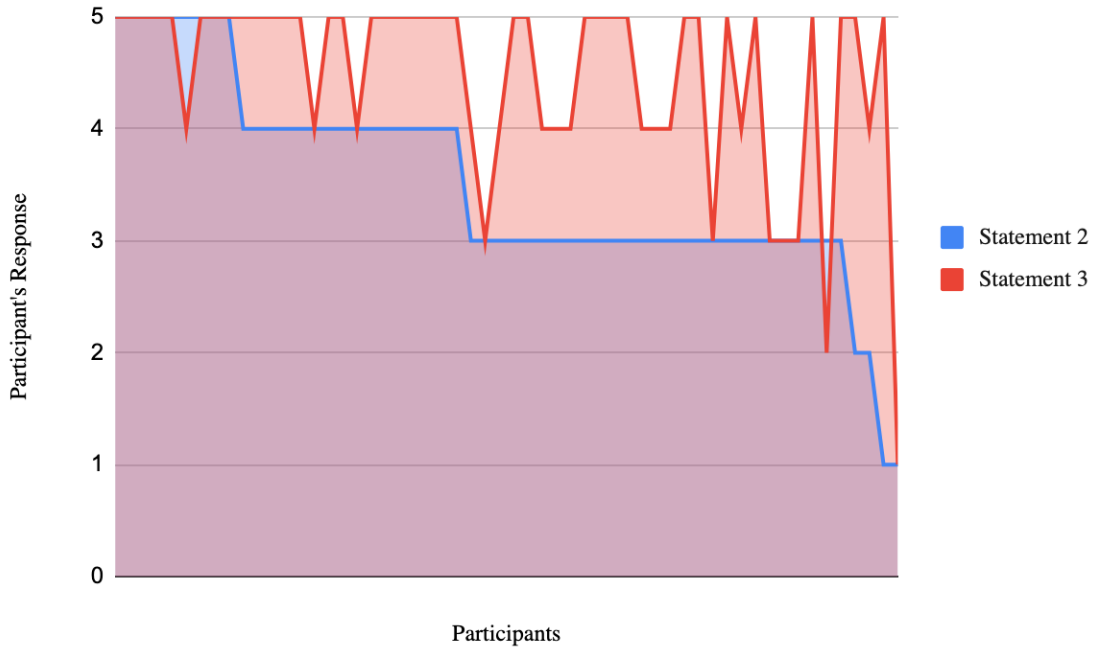


Graph 3. Climate Change Responses of Statement 1 and 3

Note. This stepped area graph shows the comparison of responses from "statement 1," CC.1, and "statement 3," CC.3, in the climate change category from all 56 respondents. The x-axis on this graph, which represents participants, has been sorted by the data from CC.1 to group the CC.1 responses from high to low value. Statements 1 and 3 are still paired with their respective participant ID.

The overall average response of the electric vehicles category was 3.84, which was slightly lower than the 4.14 climate change average. From this statistic, it can be seen that the participants somewhat agreed with or were indifferent about the electric vehicle statements. Although no conclusion can be inferred from this

average, other observations can be made from the responses of the individual statements. One relevant observation was that cost would play a significant factor in the participants' willingness to purchase electric vehicles. As seen in the scatter plot below, there is a positive correlation between EV.2, "it is worth paying a premium for an electric vehicle" shown in blue, and EV.3, "if there was no difference in the purchase price of the vehicles, you would rather purchase an electric vehicle than an internal combustion engine vehicle (conventional gas car)" shown in red. The most common response to EV.2, labeled "Statement 2" in Graph 4, was 5, which demonstrates that if electric vehicles were more affordable, then many would rather purchase an electric vehicle. The drop off in EV.3, labeled "Statement 3," in Graph 4, shows that the price premium for electric vehicles affects the respondent's attitude towards electric vehicles. This explains that the respondents were more concerned about the price of electric vehicles than the benefits of these vehicles. Their overall perceived satisfaction was consequently lowered.



Graph 4. Electric Vehicle Responses of Statement 2 and 3

Note. This area chart shows the comparison of EV.2, labeled as "Statement 2" and EV.3, labeled as "Statement 3" of topic in electric vehicles from all 56 respondents. The x-axis on this graph, which represents participants, has been sorted by the data from EV.2 to group the EV.3 responses from high to low value. Statements 2 and 3 are still paired with their respective participant ID.

These two sub factors help explain the weak, yet positive correlation between views on climate change and the willingness to purchase an electric vehicle. Although climate change concerns do play a role in the interest in electric vehicles for Generation Z, cost is still a large factor that has to be considered.

Other Relevant Data

Aside from the correlational study and the subanalysis above, there are other notable trends in the data that should be addressed. First, exactly 50% of the participants responded that they are interested in purchasing an electric vehicle or already own one. Their "interest" is signified by a score of four or higher on the EV.4 statement. This disproves one of my assumptions that high schoolers would be more adaptive of electric vehicles due to Generation Z's willingness to learn about and adopt new technology. However, as seen in the responses to EV.1, 73% of the respondents do recognize that electric vehicles are beneficial to society. This further proves the conclusion from the subanalysis that there are other factors more important than environmental sustainability, such as price, that are considered when purchasing an electric vehicle. It can also be seen through the data that 82% of the participants agreed with CC.4, which read "Climate change should be a highly prioritized issue in politics." This was useful for possible implications of this study.

Implications

Climate change is an extremely relevant topic today. Researchers say that the damage done by climate change may become irreversible by the year 2050 if no action is taken. This time frame, however, varies from source to source. The conference at the United Nations from March 2019 stated that there are only 11 years left to "avert catastrophe" (United Nations, 2019). The youth will be the most affected in our society by climate change, hence why some of the leading environmental activists are young people, like the 17-year-old Swedish climate change activist Greta Thunberg. Despite the small scale of my survey and the insignificant outcome of the correlational study, this research project helped gain insight on what average high school students think about climate change and electric vehicles. To reiterate, almost all students I sampled responded that they have a basic understanding of and concern towards climate change. Mostly, these same students responded to also have an interest in electric vehicles if the cost of such vehicles was more affordable. It is not unreasonable to say that climate change was a factor in their interest in electric vehicles as well, as shown by the positive correlation. Since this generation of students will soon be part of the largest consumer group buying vehicles, it will be important to target sponsored social marketing[6] of electric vehicles towards them. From my study, it can be seen that a majority of the respondents believe that climate change should be an issue of higher priority in politics. Accordingly, government sponsored social marketing campaigns could be very influential for this generation. In order to reduce CO2 emissions significantly, every household's second car, if they have more than one car, should be an EV by 2050. On a yearly basis, this could reduce CO2 emissions globally by 1.5 gigatons (University of Exeter, 2020). In terms of the price for EVs, my study shows that it is also crucial for advances to be made to bring down the cost of an EV without compromising its looks and functionality. The Tesla Model 3, Chevrolet Bolt, and Nissan Leaf are all top selling affordable EVs with starting prices from $31k-$36k (Kane, 2020). Although these are not the least expensive cars on the market, with gas prices and tax rebates accounted for, the cost for each of these three EVs are comparable to the average starting price of ICEVs in the United States.

Limitations/Explanations

It is important to note that this study was limited by location. Most of my peers who were prompted to take the survey are from Van Nuys High School in California. This is a Title I[7] public school in LAUSD[8], meaning that

[6] Social marketing is a marketing technique used to change people's behaviors for the benefit of society as a whole (Weinreich, 2006).
[7] "The purpose of Title I is to provide all children significant opportunity to receive a fair, equitable, and high-quality education, and to close educational achievement gaps" (Van Nuys High School, 2017).
[8] Los Angeles Unified School District

over 80% of the students qualify for free or reduced-priced lunches. If the survey were to be taken by a population at a different school where the demographic of students come from families that have higher disposable income, the results may have turned out differently.

In addition, it is not realistic for most high school students to be shopping for new vehicles at this stage in their life. Most are not in a financial position to do so. Also, since EVs are a relatively new type of car in the market, we cannot be certain in how these cars will perform and age over the long run. This uncertainty might have been reflected in some of the participants' responses.

Further Research

Further research at different high schools across California and the United States would be beneficial to understanding how demographics played a role in the responses to the survey. Other states or regions with large populations of drivers and high levels of air pollution from CO2 emissions would also benefit from performing research similar to this. It will allow EV manufacturers and governmental entities to find their best target audience for marketing. California already has the highest number of sold units of the Tesla Model 3, so another state with less current interest in EVs would be a good location for this study. In addition, it would be beneficial to utilize a larger sample size. My study only gathered 56 participants, but further research on a larger scale of high schoolers may gather more accurate and precise results in an effort to find an overall consensus. Lastly, my survey required each participant to self-report their opinions on climate change and electric vehicles. This might result in inaccurate data. A quiz to test the knowledge of climate change might be more helpful in determining what level of interest someone has in the topic.

Conclusion

Based on the results presented, a high school student's view on climate change does not necessarily influence that student's perception of an electric vehicle. My hypothesis, which stated that there would be a positive correlation between these two topics, was shown to be incorrect. Nonetheless, my study did provide some valid results and new understandings. In the first part of the study, the participants were surveyed to understand their level of awareness and concern about climate change. Almost all participants recorded that they believe climate change is a real issue, however, their awareness alone may not influence their lifestyle choices to lessen the problem. I also expected a majority of these participants to show an interest and a high level of acceptance towards electric vehicles. Though half of the respondents expressed interest in purchasing an electric vehicle, they were more concerned about the price of electric vehicles than the societal benefits of the cars. From this study, it might be inferred that if the price premium were not a factor, then electric vehicles would be a desired vehicle by these high school students who care about climate change. In the future, the use of social marketing campaigns, which was one of the techniques recommended in Bennet and Vijaygopal's study, might further encourage favorable attitudes towards EVs and could be used to target this younger demographic to tout the unique features of an EV. However, the more important factor is to reduce the price point of EVs to eliminate the price premium of EVs over ICEVs in order to attract the high school cohort of Generation Z to choose an EV as their preferred vehicle.

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