

## **The Bias of Knowledge: the Role of Environmental Knowledge in Public Opinion Formation**

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### **ABSTRACT**

Studying public environmental opinion is fundamental to understanding the factors influencing the decisions potential voters make when formulating and expressing policy preferences on environmental issues. Environmental knowledge may represent an important precursor in the development of informed opinions on environmental issues. However, little research has been conducted relating these variables directly, rather most studies utilize demographic explanations for distinct manifestations of either variable in isolation. In this study, I investigated whether greater environmental knowledge leads to the development of distinct policy preferences. To address this question, I developed a survey of questions intended to generate two scores quantifying the environmental knowledge and opinions of survey respondents. I posed objective knowledge questions and parallel subjective opinion questions for three categories of environmental issues: climate change, energy, and sustainability. I distributed this online survey to Berkeley students in ESPM 50AC: "Introduction to Culture and Natural Resource Management" of which three-hundred students from a variety of majors and backgrounds responded. Higher environmental knowledge scores were shown to correlate with more "pro-environmental" opinions on various policies and reforms. Moreover, I found significant demographic trends in environmental knowledge, opinion, and the relationship between these variables. These findings have important implications for the field of environmental politics and the prospect of reform through educational campaigns or information advocacy. The relationship between knowledge and public opinion also has significant implications for our understanding of democratic accountability and informed political decision-making.

### **KEYWORDS**

political knowledge, specific knowledge, informed opinions, democratic accountability, online survey

## INTRODUCTION

Existing research of public environmental opinion primarily emphasizes the relationship between demographics and environmentalism, with various explanations and underlying mechanisms for these effects. Moreover, other literature explores behavioral factors similar to environmental opinion in great detail, including a variety of relatively synonymous terms such as environmental “concern, attitude and world view” (Arcury 1990). Yet, for understanding political processes in democracies it may be most relevant to evaluate *opinions* in terms of policy positions, as voters are faced with similar decisions when choosing representatives or voting on referenda. Political communities connected through shared characteristics and interests are often on the forefront of activism and may provide the public support necessary to move important issues onto the political agenda and enact reform (Ansolabehere and Konisky 2009). For example, one study found women to be more likely than men to support environmental protection and extrapolated that “collectively females will be influential in future environmental activism, policy development, and political leadership” (Zelezny et al. 2000). Alternatively, fundamentalist religious participation in rural North Carolina correlated strongly with disapproval for progressive environmental reforms, with one explanation arguing that these individuals tended to have a greater adherence to a “man versus nature worldview” (Clifford et al. 2003). Such perspectives may be related to the accessibility of scientific information and how it is perceived or accepted in particular communities. The underlying factors that facilitate opinion are of vital interest as they may help identify potential avenues for environmental reform.

Political knowledge is fundamental to informed decision-making and individual civic engagement, and the literature focuses heavily on normative concerns of distinct demographic trends of knowledge in society. For example, race and ethnicity are shown to have strong relationships with political knowledge, in addition to political engagement, participation, and opinions (Bowler and Segura 2012 & Wolbrecht and Hero 2005). Distinguishing between the effects of broader civic or political knowledge and issue specific knowledge has also been the focus of significant research. Specific knowledge is shown to be closely associated with levels of education and income in particular (Arcury 1990 & Walstad 1997). One study finds that economic knowledge was shown to have significant effects on individuals’ opinions about many economic issues (Walstad 1997). Moreover, this relationship varied greatly between demographic groups

and was most observable in disaggregated analyses compared to the survey population as a whole (Walstad 1997). For example, the correlation between knowledge and opinion was greater for adults who had taken college economic courses compared to adults who had only taken high school courses (Walstad 1997). These findings suggest that education plays an important role not only in fostering knowledge directly, but also its application to political opinion. These findings support a causal mechanism by which knowledge may influence opinions.

This direct relationship between environmental knowledge and opinion is of vital interest as it may represent an effective way to evaluate if individuals are making informed decisions on environmental issues. Although studies connecting environmental knowledge and opinion are limited, environmental knowledge has been shown to positively affect “environmental attitudes” (Reiner et al. 2005 & Arcury 1990). Unfortunately, public environmental knowledge is generally low (Arcury 1990). These findings in tandem highlight the importance environmental knowledge in affecting behaviors and perceptions of the environment. Adhering to this assumption, low knowledge of environmental issues may help to explain historically low public support for environmental reform (Arcury 1990 & Grove-White et al. 2006). Understanding the relationship between environmental knowledge and opinion is essential to exploring the capacity of the public to embrace new environmental policies and to fostering a more informed electorate.

### **Research questions and hypothesis**

The primary focus of my study was to evaluate the relationship between environmental knowledge and opinion. Based on previous literature concerning environmental and non-environmental political psychology and behavior I hypothesized that individuals with greater environmental knowledge will tend to express more “pro-environmental” opinions. I also addressed various sub-questions that contextualize the central relationship between environmental knowledge and opinion. First, I sought to understand what can be concluded from the raw distributions of environmental knowledge and opinion in a population. Second, I evaluated how the relationship between knowledge and opinion differs across environmental issues. Third, I explored differences in this relationship across demographic groups. Fourth, I attempted to address potential alternative explanations and balance them with the limitations of my study.

## METHODOLOGY

### Survey design

I developed a survey of questions intended to generate two variables representing the environmental knowledge and opinion of respondents. The survey included a set of demographic questions followed by pairs of parallel knowledge and opinion questions that spanned three specific issue categories: energy, climate change, and sustainability. The knowledge questions required respondents to identify factual details concerning a range of environmental topics using only prior learning. The opinion questions prompted respondents to think critically and provide a statement of support or opposition for a range of policy solutions, many of which may be considered controversial.

Three hundred students in the ESPM 50 AC course completed the survey after self-selecting into participation for extra credit. The survey included a total of seven knowledge questions and six opinion questions. The survey additionally posed three concern questions that asked whether the categories deserved attention and nine demographic questions which determined each respondent's gender, ethnicity, race, hometown community type, age, college year, political identification, religious participation, and major.

### Variables

To develop a knowledge variable for each respondent, I calculated a score based on the total number of objective knowledge questions he or she correctly answered. This value was treated as an independent variable based on the assumption that an individual's knowledge cannot be changed by their opinions. This discrete variable ranged from zero to seven corresponding with the seven environmental knowledge questions. Individuals with a score of zero failed to answer any knowledge questions correctly while those with a score of seven provided correct answers to all the knowledge questions. I used block and question randomization, with all knowledge questions being shown in a random order and the order of all answer choices randomized.

To evaluate environmental policy preferences, I developed an opinion score for each respondent. I treated this score as the dependent variable based on the hypothesized relationship

in which knowledge positively influences opinion. Respondents were asked to provide their opinions on various environmental policies and proposals on a five-point Likert scale, with one being strong opposition and five being strong support. Block and question randomization was again used such that all opinion questions were presented in a random order, but were placed before the knowledge questions. I then averaged these values to develop an opinion score for each respondent on the same one to five scale.

To evaluate the potential intermediary role of environmental concern, I developed a concern score for each respondent from three questions that asked to what degree each issue category deserved attention on the same five-point Likert scale as the opinion questions. This variable does not relate to the central research question, but concern is a potential confounding variable whose effects will be further explored in the discussion section of this paper.

## **Data Analysis**

For environmental knowledge and opinion, I determined and plotted the distribution of scores within the survey population and calculated other relevant descriptive statistics. Using Stata, I then tested the correlation between environmental knowledge and opinion scores and employed linear regression to examine this relationship. I also used ANOVA to compare the discrete knowledge scores to the continuous opinion scores as each consecutive value for the knowledge score was expected to have a unique distribution of opinion scores. I then compared concern scores to the knowledge and opinion scores separately to evaluate these relationships with environmental concern. I conducted linear regressions and graphed the concern relationships using sunflower density distribution plots.

To refine my examination of the relationship within each issue category, I developed knowledge and opinion scores separately for each of the three issue categories and tested the relationship between knowledge and opinion for each category. This breakdown was also done to evaluate the rigor of the questions posed in each sub-category.

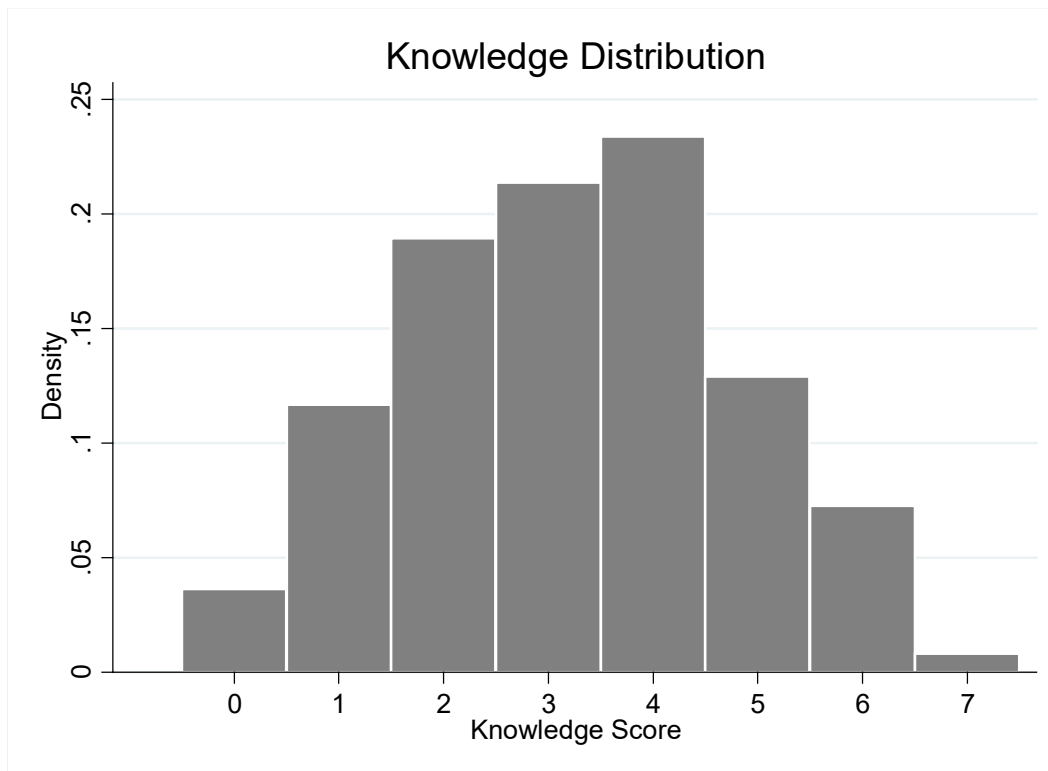
Additionally, I compared these analyses along demographic lines to evaluate how responses differed across distinct groups. For example, I found the correlations and applied linear regression to the knowledge and opinion scores of women and men separately, to evaluate the

effects of gender on this relationship. I did the same for ideology, religious participation, and self-identified ethnicity.

## RESULTS

### Knowledge Distribution

The values of the respondents' knowledge scores ranged from 0 to 7, corresponding with the number of objective knowledge questions each respondent correctly answered. The mean knowledge score for the combined group was 3.16 out of 7, with a standard deviation of 1.57. Of the 301 respondents, nine had knowledge scores of 0 and two respondents scored the maximum of 7. The knowledge scores had a relatively normal distribution (Figure 1).



**Figure 1. Distribution of Knowledge Scores.** Density histogram of discrete knowledge scores (n=301).

## Opinion Distribution

Values for the averaged opinion scores ranged from 1 to 5, representing the spectrum from anti- to pro-environmental opinion respectively. The mean opinion score was 3.91, with a standard deviation of 0.77. The distribution of opinion scores was skewed towards the “pro-environmental” opinion (Figure 2).

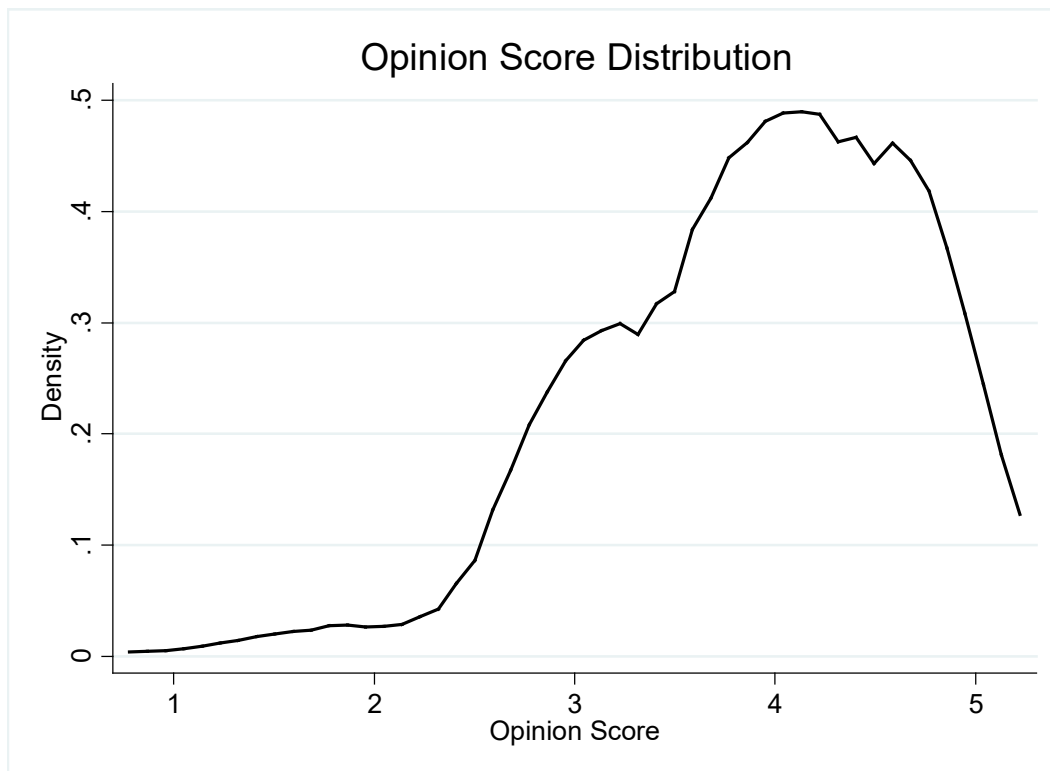


Figure 2 Distribution of Opinion Scores. (n=301)

## Knowledge-Opinion Relationship

I found the correlation between knowledge and opinion scores for all questions and all respondents to be 0.22. Linear regression yielded a coefficient of 0.087 with high statistical significance ( $p=0.002$ ). Using ANOVA, differences were found in the distribution of opinion scores with each consecutive step in knowledge score (Figure 3).

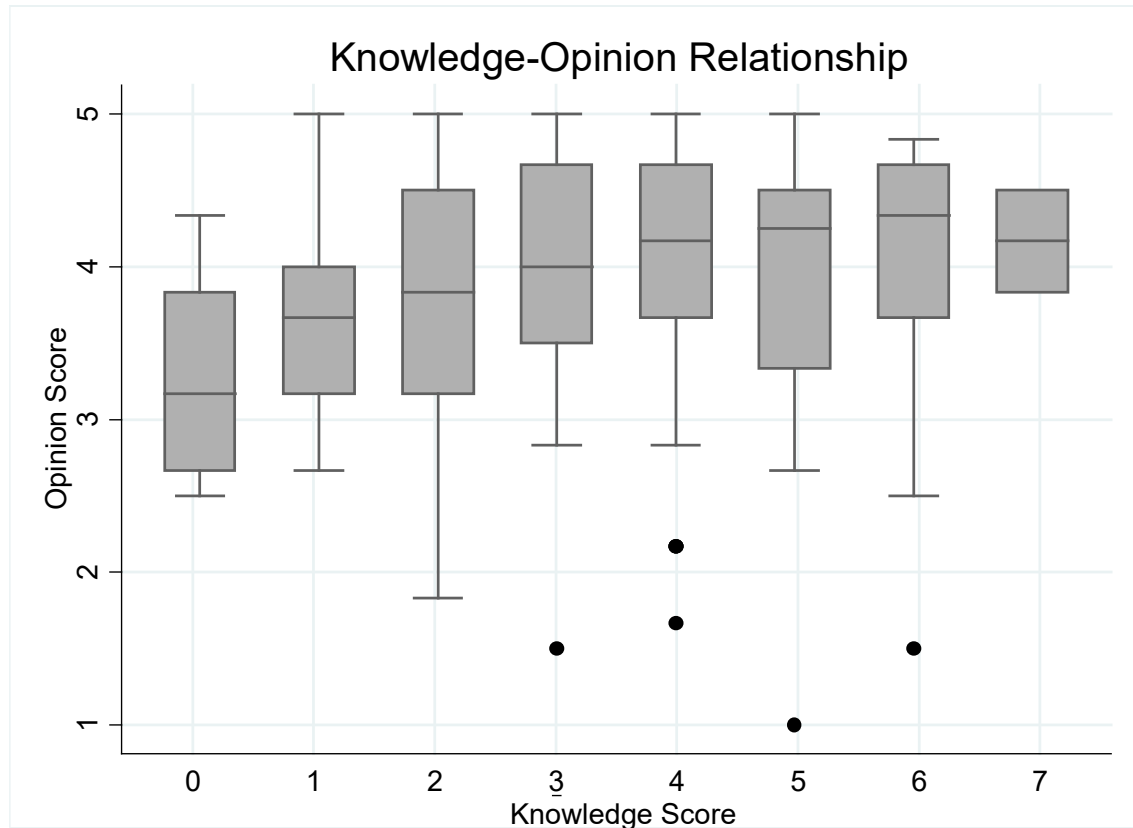


Figure 3 Knowledge-Opinion boxplots.

### Concern Variable and Multi-Variate Relationships

Concern scores ranged from 1 to 5, representing low to high environmental concern respectively. The mean concern score was 4.33 with a standard deviation of 0.84. Concern scores correlated moderately with knowledge scores and very strongly with opinion scores. I found the correlation between environmental knowledge and concern to be 0.28. Linear regression of these variables yielded a coefficient of 0.15, at a very high level of statistical significance ( $p < 0.001$ ) (Figure 4). I found the correlation between environmental opinion and concern to be 0.73. Linear regression yielded a coefficient of 0.8, with a very high degree of statistical significant ( $p < 0.001$ ) (Figure 5).



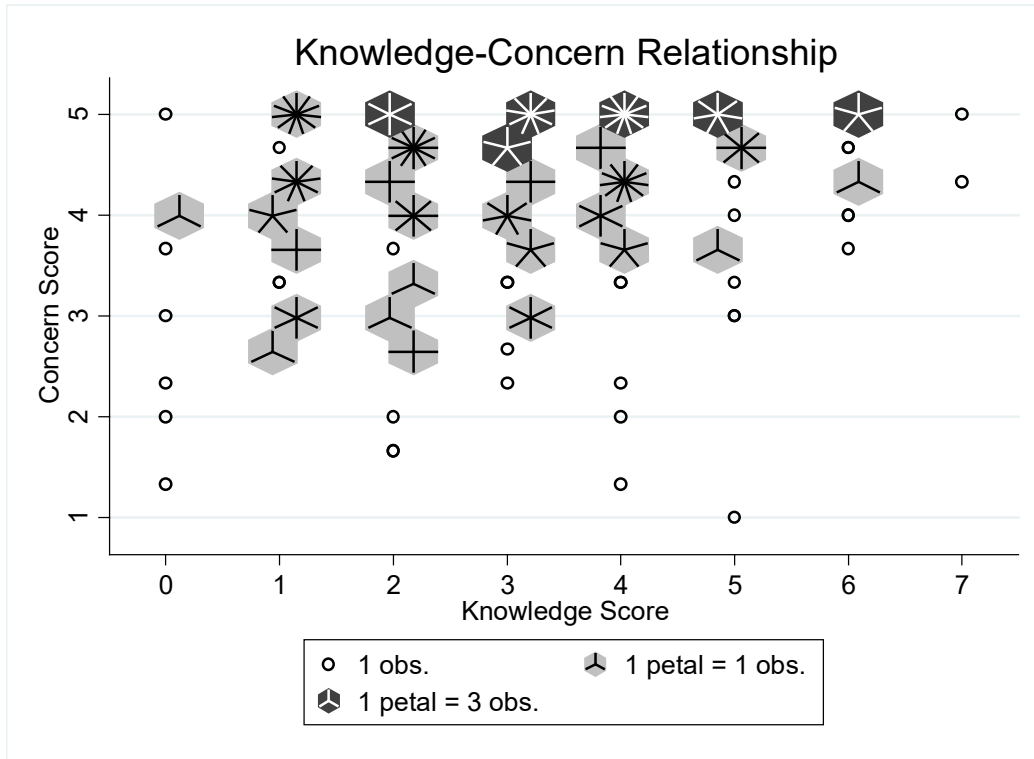


Figure 4 Knowledge-Concern Relationship. Sunflower density-distribution plot.

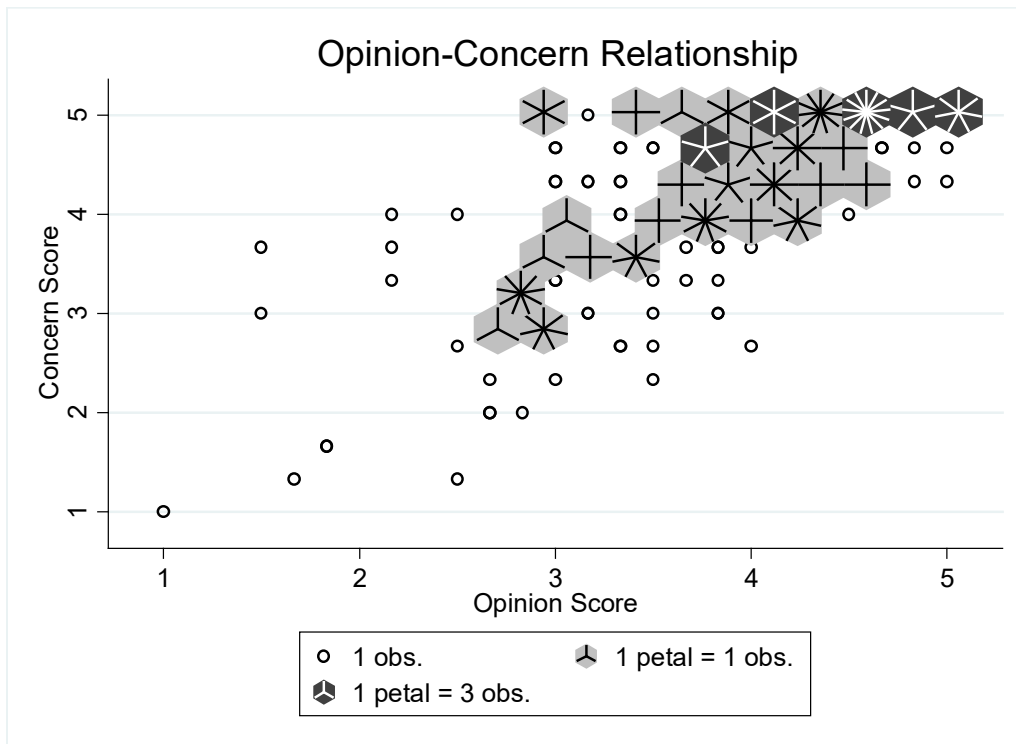
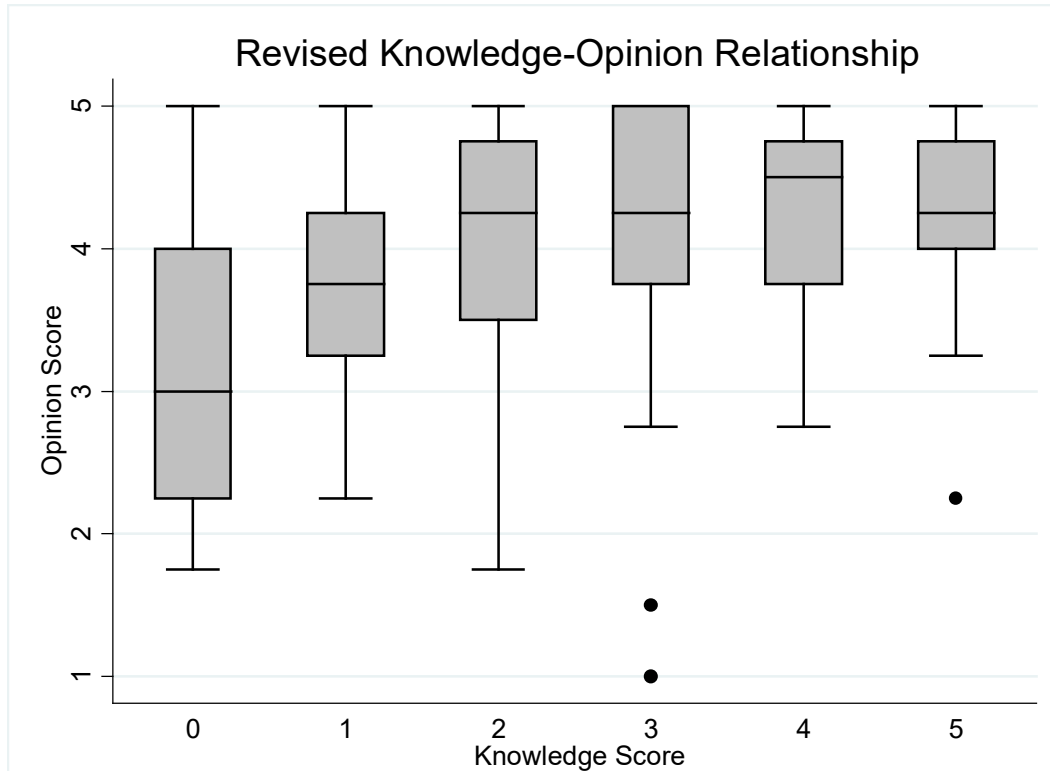


Figure 5 Opinion-Concern Relationship. Sunflower density-distribution plot.

## Categorical Breakdown

I also found the correlations between knowledge and opinion scores for each of the three specific environmental issue categories addressed in the survey. For climate change related questions, the mean knowledge score was 1.07 out of 2 with a standard deviation of 0.77 and the mean opinion score was 4.00 with a standard deviation of 0.91. The correlation between knowledge and opinion scores for climate change was found to be 0.22. Linear regression yielded a coefficient of 0.27 with high statistical significance ( $p=0.001$ ). For energy related questions, the mean knowledge score was 1.41 out of 3 with a standard deviation of 0.86 and the mean opinion score was 4.08 with a standard deviation of 0.89. The correlation between these variables was found to be 0.16. Linear regression yielded a coefficient of 0.17 that was statistically significant ( $p=0.026$ ). For sustainability questions, the mean knowledge score was 0.71 out of 2 with a standard deviation of 0.7 and the mean opinion score was 3.75 with a standard deviation of 0.94. The correlation between sustainability knowledge and opinion was found to be -0.06. Linear regression yielded a coefficient of -0.8 but statistical significance cannot be claimed ( $p=0.419$ ).

In order to evaluate the potential error associated with the highly erratic responses to the sustainability questions, I conducted additional analyses after aggregating only the energy and climate change questions into “revised” knowledge and opinion scores, while removing the sustainability questions entirely. The mean revised knowledge score was 2.48 out of 5 with a standard deviation of 1.23 and the mean revised opinion score was 4.04 with a standard deviation of 0.82. The correlation between the revised variables was found to be 0.28. Linear regression yielded a coefficient of 0.19 with very high statistical significance ( $p<0.001$ ). The pairwise distribution of revised knowledge and opinion scores reveals a somewhat stronger relationship (Figure 6). Potential implications of these additional findings broadly and with respect to the validity of my study will be explored in the discussion section of this paper.



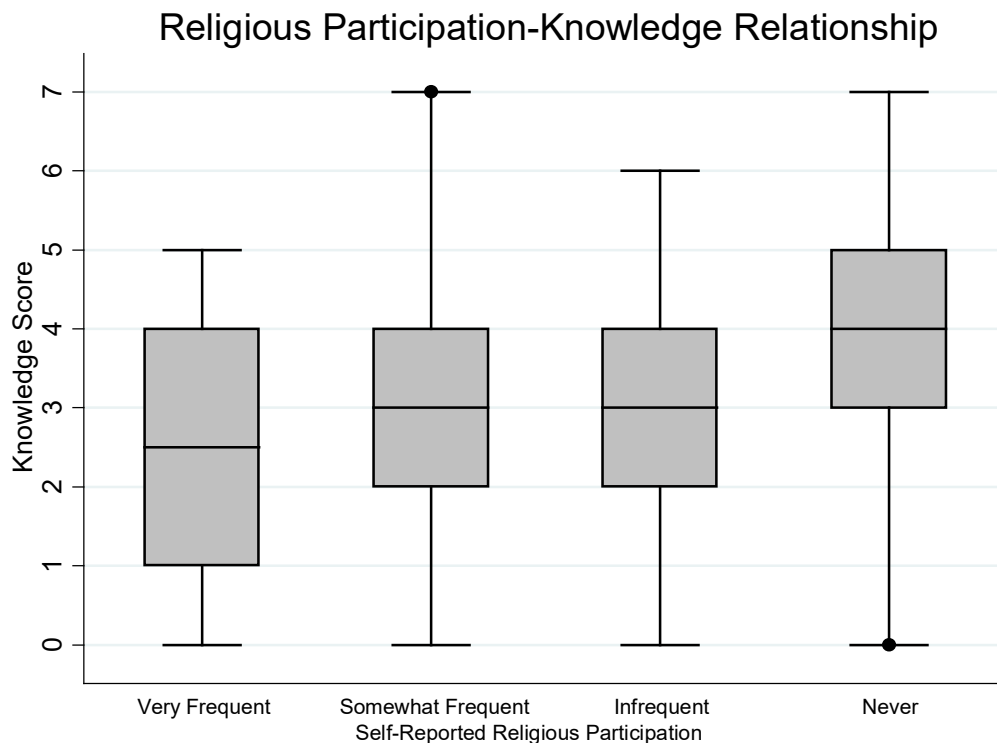
**Figure 6 Revised Knowledge-Opinion Relationship.** The relationship between knowledge and opinion scores appears to be stronger than in the non-revised analysis including all survey questions.

### Critical Demographic Identifiers

Self-reported ideology along a conservative-liberal spectrum was found to be significantly correlated with environmental opinions and concern, but rather weakly with knowledge. An important qualifier is whether respondents self-identifying as “Independents” are included in this analysis, and the rationale behind either choice will be further elaborated in the discussion section of this paper. The correlation between ideology and total opinion score was found to be 0.42 when independents were included and 0.46 without. Moreover, linear regression yielded coefficients of 0.31 with independents and 0.34 without, both with high statistical significance ( $p < 0.001$ ). The correlation between ideology and concern score was found to be 0.29 with independents and 0.32 without. Linear regression yielded coefficients of 0.24 with independents and 0.26 without, both with high statistical significance ( $p < 0.001$ ). The correlation between ideology and knowledge scores was 0.07 with independents and 0.08 without. Linear regression yielded coefficients of 0.10

with independents and 0.12 without, but neither finding can be concluded as statistically significant ( $p=0.25$  and  $p=0.18$  respectively).

Self-reported religious participation, through the choices of very frequent, somewhat frequent, infrequent, and never, was found to have significant relationships with knowledge and self-reported ideology such that individuals with lower religious participation tended to have higher knowledge scores and were more liberal than more religious respondents. The correlation between knowledge and religious participation was found to be 0.2, while linear regression yielded a coefficient of 0.32, with high statistical significance ( $p<0.001$ ) (Figure 7). The correlation between opinion scores and religious participation was found to be 0.24, while linear regression yielded a coefficient of 0.18, with high statistical significance ( $p<0.001$ ). Moreover, I found the correlation between ideology and religious participation to be 0.31, while linear regression yielded a coefficient of 0.32, with high statistical significant ( $p<0.001$ ).



**Figure 7 Religion-Knowledge Distributions**

When the knowledge-opinion relationship was broken down by gender, my analyses yielded divergent results. Female respondents had a mean knowledge score of 2.93 with a standard deviation of 1.49 and a mean opinion score of 4.11 with a standard deviation of 0.69. I found the

correlation between knowledge and opinion scores for women to be 0.29, while linear regression yielded a coefficient of 0.13 with high statistical significance ( $p < 0.001$ ). The mean knowledge score among male respondents was 3.37 with a standard deviation of 1.62 and the mean opinion score was 3.71 with a standard deviation of 0.79. I found the correlation between knowledge and opinion scores for men to be 0.17, while linear regression yielded a coefficient of 0.09 with statistical significance ( $p = 0.033$ ).

When these analyses were conducted for self-identified ethnicity, the relationships between knowledge and opinion were quite distinct. Respondents identifying as Asian ( $n = 189$ ) had a mean environmental knowledge score of 3.10 with a standard deviation of 1.57 and a mean opinion score of 3.83 with a standard deviation of 0.75. The correlation between Asian respondents knowledge and opinion scores was found to be 0.10 while linear regression yielded a coefficient of 0.05, but statistical significance cannot be concluded ( $p = 0.194$ ). Respondents identifying as white ( $n = 119$ ) had a mean environmental knowledge score of 3.34 with a standard deviation of 1.56 and a mean opinion score of 4.07 with a standard deviation of 0.79. I found the correlation between knowledge and opinion scores for white respondents to be 0.27, while linear regression yielded a coefficient of 0.13 with high statistical significance ( $p = 0.001$ ). Unfortunately there were insufficient numbers of survey respondents identifying as Hispanic/Latino ( $n = 19$ ), American Indian ( $n = 3$ ), or black ( $n = 5$ ) to draw conclusions.

## DISCUSSION

### Introduction

The aforementioned findings have both narrow and broad implications for the field of environmental opinion research and for the prospects of reform through information advocacy or education policy. First, the raw distributions of the knowledge and opinion scores help establish the representativeness of my sample population. Next, the findings of primary interest focus on the central relationship between knowledge and opinion as they represent a potential mechanism for public opinion formation through knowledge acquisition, which has implications for reform efforts and normative considerations of improving the health of American democracy. I then present a battery of alternative explanations, including concern as a potential confounding variable

and reverse causality in which strong opinions may lead individuals to seek information and become more knowledgeable. When broken into the individual environmental issue categories of energy, sustainability, and climate change, this relationship has more narrow implications for specific “issue knowledge”, in contrast to the broader notions of environmental knowledge or political knowledge in general. Additionally, substantial differences in these variables and their relationship across various demographic groups helps to contextualize the practical importance of knowledge and its implications for public opinion formation. I then discuss the limitations of my study by evaluating the effectiveness of this methodology for quantifying knowledge and opinion. Finally, I consider the quality of my study population and discuss future directions of research. I conclude by exploring the broader significance of my study, emphasizing the empirical contribution and broader normative implications.

### **Implications of raw knowledge distribution**

The knowledge scores resembled a normal distribution suggesting that the seven objective survey questions adequately evaluated environmental knowledge and distributed respondents accordingly on a spectrum from low to high knowledge. Previous research on general political knowledge similarly found that in the aggregate at the national level knowledge tends to exhibit a normal distribution around a centralized median (Rahn 1999). The observed normality in my study implies a higher degree of question rigor and extrapolatability to the greater American public.

The normal distribution also suggests that my sample is less biased than might be expected of Berkeley students in an environmental science course, who are highly-educated and potentially more interested in environmentalism than the general student body. This leads to two alternative conclusions of the role of education in the formation of political knowledge. First, the average student-respondent may in fact have relatively high environmental knowledge but the difficulty of my questions may have diminished this result. Second, these findings support previous research that suggests classroom-based “formal education” may not have as dramatic an effect on political knowledge as “civic education” (Galston 2001). The latter explanation contradicts the notion of environmental knowledge as requiring a level of scientific understanding almost exclusively reserved for the classroom. It is important to contextualize the results with the timing of the survey, which was conducted at the end of the ESPM 50AC course in which these students received

instruction on the sociopolitical consequences of historical and contemporary environmental issues.

### **Implications of raw opinion distribution**

The opinion scores tended to be skewed towards the “pro-environmental” opinion calling into question the representativeness of the study population and the effectiveness of the opinion questions. First, the sample population is disproportionately representative of the demographic groups that are more likely to hold “pro-environmental” views; the respondents are young, highly educated, and would be expected to be more environmentally concerned because they elected to take an environmental science course. Second, the subjective opinion questions may be prone to error for two main reasons. Students may attempt to appear more “pro-environmental” because they are taking such a course and may be concerned with how their responses are viewed, regardless of an affirmation of anonymity. Moreover, some of the questions themselves may not be adequate evaluators of opinion for a variety of reasons including how the scale is understood, the specific wording of the questions, and the choice of sub-issues, which was based primarily on the ease of constructing parallel knowledge and opinion questions. Nonetheless, important implications persist when the opinion scores are compared among demographic groups as potentially confounding factors such as education are implicitly controlled for within this study population. Regardless of the representativeness of my sample population or either variable in isolation, comparing the relationship between these variables informs our understanding public opinion formation in the context of environmental knowledge.

### **The central relationship between knowledge and opinion**

The positive correlation between knowledge and opinion scores implies that individuals with greater environmental knowledge express more “pro-environmental” political opinions. (Figure 3) shows that there is a broader range of opinions for lower knowledge individuals (knowledge score  $\leq 3$ ), while individuals with higher knowledge (knowledge score  $\geq 4$ ) tended to have a narrower range of more pro-environmental opinions, excluding a few outliers. As previously mentioned there is a gap in the literature because there has been little previous research

relating knowledge and opinion, making the affirmation of a causal mechanism rather difficult. Nonetheless, in a normative sense it is critical that the information individuals have about an issue is taken into account when formulating policy preferences. One of the few previously proposed mechanism for the relationship between knowledge and opinion is politically knowledgeable individuals are better able to form and express “opinions consistent with their political predispositions” (Althaus 1998). Under this argument, opinions may not be transformed by political knowledge, but rather greater knowledge enables individuals to more accurately express policy positions consistent with their preexisting ideological orientation. The relative consolidation of pro-environmental opinions for higher knowledge respondents in my study provides some initial evidence for this framework. The counter implication of this mechanism is that lower knowledge individuals are more likely to express policy positions that conflict with their ideological predisposition and would exhibit a more random distribution as is potentially visible in my results.

### **Alternative explanations**

The strong correlation between concern scores and opinion scores ( $p=0.8$ ), and the moderate relationship between concern and knowledge ( $p=0.15$ ) provides some initial evidence that concern may represent a confounding variable. Individuals concerned about environmental issues appear to express more “pro-environmental” opinions, and may be more inclined to learn about the issues. However, it is important to note that the opinion and concern questions were posed together and with identical scales for response choices such that many respondents likely treated concern as a proxy for opinion. While concern tended to be high for the entire sample, (Figure 4) suggests as individuals become more knowledgeable their environmental concern scores consolidate towards the maximum of 5. If greater knowledge increases concern, thereby increasing opinion in terms of support for policies to address environmental issues, concern as a confounding variable does not necessarily diminish the implications of the direct relationship between knowledge and opinion. Instead concern highlights the importance of this relationship and reveals a potential causal mechanism.

It is most logical to assume that any direct relationship is best explained as knowledge influencing opinion through the individual decision-making process, but it is also plausible that



some individuals' strong opinions on an issue may lead them to research the topic and become more knowledgeable. I attempted to address this potential issue of reverse causation in two ways. First, I ensured that the objective knowledge question targeted very specific information rather than broader knowledge about an issue that may otherwise be inferred through concern or general familiarity with the topic. Second, I organized the knowledge and opinion questions into three distinct environmental issue categories to potentially lessen reverse causation when the questions from all the categories were aggregated. This parallel structure also allowed me to analyze additional richness of the relationship on a per-issue basis and to explore potential implications of specific "issue knowledge".

### **Issue-category breakdown**

The correlation between knowledge and opinion scores for each of the three categories: climate change, energy, and sustainability, may provide insight into the salience of each issue area in terms of whether individuals effectively translate relevant knowledge into pro-environmental opinions. The standardized knowledge means for the three categories were: climate change = 0.54, energy = 0.47, sustainability = 0.36, suggesting that the student respondents know the most about climate change issues, followed by energy, and then sustainability. Similarly, the categorical opinion means were: climate change = 4.00, energy = 4.08, and sustainability = 3.75, suggesting that students on average expressed somewhat more pro-environmental views on the issues of climate change and energy compared to sustainability; although it should be noted that the sustainability opinion questions related to policies that involved changing individual behaviors and consumption patterns, which could understandably illicit less favorable responses. Moreover, while the climate change and energy questions yielded correlations between knowledge and opinion of 0.22 and 0.16 respectively, the sustainability questions yielded an insignificant correlation of -0.06.

This distinction between the sustainability questions and the other categories suggests either significant differences in the way individual respondents approached the sustainability questions or the questions themselves may be poorly constructed and represent a source of error in the aggregated analyses. The two sustainability opinion questions prompted respondents to provide a statement of support or opposition to banning plastic bags or increasing CRV taxes, both

of which represent additional costs assumed by society and individuals. Respondents may have been more conscious of the direct effects of these policies, perhaps making it difficult to compare with opinions from the other categories such as instituting a carbon-tax or regulating mining both of which have abstract costs primarily incurred by corporations rather than individuals. Moreover, the sustainability knowledge questions tended to be significantly more difficult for respondents to correctly answer, suggesting that the questions themselves may be inappropriate for evaluating the relationship between knowledge and opinion. Once the sustainability questions were removed, there was a significant upward shift in the correlation between knowledge and opinion which provides evidence that the sustainability section is suppressing my aggregated results. Even when broken down by issue category, potential richness of the data may be lost by aggregating the responses across individuals, while significant results for particular demographic groups may help to identify the underlying role of knowledge in opinion formation.

### **Demographic implications**

There exist important implications that arise when comparing the relationship between knowledge and opinion across individual demographic groups that contribute to our broader understanding of opinion formation. The relatively strong correlation between self-identified ideology and political opinion provides support for the effectiveness of the opinion questions. Conversely, the very weak and potentially insignificant relationship between ideology and knowledge suggests in general ideology seems to have very little effect on knowledge. This further weakens the potential of reverse causation as those respondents expected and shown to be most pro-environmental did not exhibit greater knowledge scores.

One important consideration is whether to include respondents identifying as “independent” in these analyses which assume individuals think in terms of a “Downsian unidimensional ideological spectrum” from very liberal to very conservative. Previous research suggests that survey respondents may identify as “independent” for a variety of reasons including dissatisfaction with the two major parties or the government, uncertainty or low knowledge, or true “middle-of-the-road” ideological orientation (Hajnal and Lee 2011). As a result it may be unfair to classify these individuals in between individuals identifying as somewhat liberal or conservative, and the distinctions in my analyses reflect that consideration.

When responses were compared by self-identified ethnicity, there was only a slight difference between white and Asian respondents' raw environmental knowledge or opinion scores suggesting ethnicity may not have substantial effects on these variables when controlling for level of education. Rather, the result of interest from these analyses was that the relationship between environmental knowledge and opinion was radically different for these two groups implying there may be distinct mechanisms between these groups for incorporating political knowledge into informed opinions. This finding supports the aforementioned role of knowledge in expressing opinions consistent with a preconceived ideological orientation, as previous research has shown that immigrant-based communities such as Asian-Americans and Latinos are much more likely to identify as "independent" or not to identify at all (Hajnal and Lee 2011). The prevailing explanation for this distinction is that political socialization in another country -the formation of political perceptions and understanding- causes individuals to be less likely to think in a left-right ideological dimension, which then perpetuates to their children and future generations of American citizens (Hajnal and Lee 2011). This explanation is inconclusive for my study, as most of the respondents identifying as Latino also identified as white.

Self-identified religious participation revealed interesting relationships with knowledge and opinion. Both environmental knowledge and opinion increased in similar magnitude as religious participation decreased. This is consistent with previous literature that found strong religious participation to be correlated with disapproval for progressive environmental reforms, and provides further evidence for the proposed rationale that more religious individuals may put less weight in scientific information when making political decisions (Clifford et al. 2003).

On average, female respondents exhibited significantly more pro-environmental opinions than men, while male respondents had higher average environmental knowledge scores, suggesting that gender has strong implications for these variables. The higher average environmental opinion scores for women supports previous research that found women were more supportive of environmental reforms (Zelezny et al. 2000). The greater average knowledge scores for male respondents exposes guessing as a potential source of error, as men have been shown to guess more often and more correctly than women on objective multiple-choice questions in surveys (Mondak and Anderson 2004). Knowledge score error associated with guessing would certainly weaken the central relationship between knowledge and opinion scores, as inflated knowledge scores are disproportionately male respondents who hold less favorable environmental opinions

on average. The 0.12 point difference between the correlations for men and women provides further support for this claim.

### **Limitations and Future Directions**

Future research into this relationship should utilize a more diverse study population and an improved array of survey questions. One potential issue with my study was the strong skew of “pro-environmental” opinions. Study populations including a greater diversity of ages, levels of education, and ideological predispositions would likely exhibit a greater range of opinions, with more individuals being skeptical of or opposed to various environmental reforms. An online population not connected to an environmental science course may also generate more honest responses, as the respondents to my study may have given more favorable opinion responses to appear more “pro-environmental”, potentially representing a source of “desirability bias”.

Moreover, a larger sample size would establish greater significance of demographic comparisons, as I was limited to exploring only the demographic variables most represented in my sample. Similarly, future studies may benefit from including more questions from a greater variety of environmental issue categories. Including more detailed demographic questions related to ideology, culture, and ethnicity would allow future studies to explore with greater detail the group-based distinctions in knowledge and opinions with the potential to identify underlying mechanisms in the development of these variables. My questions were self-written, but it is more appropriate for future studies to utilize question phrasing that has been repeatedly tested to reduce potential sources of error.

### **Conclusion**

The broader significance of my study is best examined in terms of the empirical contributions of my methodology and the normative implications of my results. The development of knowledge and opinion scores from objective and subjective survey questions may serve as a template for future studies seeking to quantify similarly broad concepts. The parallel structure of the questions simultaneously enabled aggregate and issue-specific analyses. These issue-specific findings have the unique capacity to expose potentially unrigorous questions that may serve as a

source of error in the aggregate. Just as my exploration of environmental knowledge as “specific knowledge” was informed by previous studies of political knowledge more broadly (Verba, Schlozman, and Burns 1997 & Soule 2001), my methodology helps to expose the advantages and limitations to using objective questions as proximate measures of specific or broad knowledge. Moreover, online surveys represent an innovative and powerful tool for the study of individual political behavior.

In a normative sense, my study highlights a potential channel towards environmental reform through the fostering of greater environmental knowledge. The proposed role of political knowledge in developing informed opinions highlights the potential for greater democratic accountability and a more responsive electorate. This claim supports the notion that “issue publics” -groups that coalesce around particularly salient issues and increase their national importance through advocacy- will play an important role in the future of environmental reform and political outcomes more broadly (Hajnal and Lee 2011). There are also significant implications for environmental advocates who might utilize education and information campaigns rather than issue-position canvassing to increase public support of environmental reforms and policies.

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## REFERENCES

- Althaus, S. L. 1998. Information effects in collective preferences. *American Political Science Review* 545-558.
- Ansolabehere, S., and D. M. Konisky. 2009. Public attitudes toward construction of new power plants. *Public Opinion Quarterly*. 73.3:566-577.
- Arcury, T. A. 1990. Environmental attitude and environmental knowledge. *Human Organization* 49:300-304.
- Bowler, S. and G. M. Segura. 2012. *The future is ours: minority politics, political behavior, and the multiracial era of American politics*. CQ Press, Thousand Oaks, California, USA.
- Clifford, W. B., J. G. Nooney, E. Woodrum, and T. J. Hoban. 2003. Environmental worldview and behavior: consequences of dimensionality in a survey of North Carolinians. *Environment and Behavior* 35:763-783.
- Galston, W. A. 2001. Political knowledge, political engagements, and civic education. *Annual Review of Political Science* 4:217-234.
- Grove-White, R., M. Kearnes, P. MacNaghten, and B. Wynne. 2006. Nuclear futures: assessing public attitudes to new nuclear power. *The Political Quarterly* 77:238-246.
- Hajnal, Z. L. and T. Lee. 2011. *Why Americans don't join the party: race, immigration, and the failure (of political parties) to engage the electorate*. Princeton University Press, Princeton, New Jersey, USA.
- Mondak, J. J., and M. R. Anderson 2004. The knowledge gap: a reexamination of gender-based differences in political knowledge. *Journal of Politics* 66:492-512.
- Rahn, W. M. 1999. Review of "What americans know about politics and why it matters" by Michael Delli Carpini and Scott Keeter. *Political Psychology* 20:207-210.

- Reiner, D. M., T. Curry, M. A. de Figueiredo, and H. J. Herzog. 2005. A survey of public attitudes towards energy & environment in Great Britain. Laboratory for Energy and the Environment, Massachusetts Institute of Technology. Cambridge, MA., USA.
- Soule, S. 2001. Will they engage?: political knowledge, participation and attitudes of Generations X and Y. ERIC Clearinghouse.
- Verba, S., N. Burns, and K. L. Schlozman 1997. Knowing and caring and caring about politics: gender and political engagement. *The Journal of Politics* 59:1051-1072.
- Walstad, W. B., and K. Rebeck. 1997. Assessing the economic knowledge and economic opinion of adults. *The Quarterly Review of Economics and Finance* 42:921–935.
- Wolbrecht, C. and R. E. Hero. 2005. *The politics of democratic inclusion*. Temple University Press, Philadelphia, Pennsylvania, USA.
- Zelezny, L. C., P. Chua, and C. Aldrich. 2000. Elaborating on gender differences in environmentalism. *Journal of Social Issues* 56:443-457.

**APPENDIX****Survey Questions**Climate Change

Do you support or oppose this statement: "Climate change is an important issue that deserves the attention of citizens and policymakers"

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose a national tax on business' carbon emissions?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose increasing emission regulations for private businesses?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

The "Cap and Trade" program is most closely related to:

1. Oil Spills
2. Nuclear Waste
3. Natural Gas
4. Carbon Dioxide
5. Methane Emissions



The country with the greatest yearly increase in carbon emissions is:

1. Germany
2. Brazil
3. United States
4. Russia
5. China

Energy

Do you support or oppose this statement: "Alternative energy production is an important issue that deserves the attention of citizens and policymakers"

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose increasing government spending on and investment in alternative energy companies?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose increasing regulations on mining and drilling companies in the United States?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose increasing government spending and investment in energy technology research?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Fracking is most related to which energy resource?

1. Tar Sands
2. Coal
3. Hydrothermal
4. Natural Gas
5. Biofuels

Which resource supplies the greatest portion of total energy produced in the United States?

1. Natural Gas
2. Oil
3. Coal
4. Nuclear
5. Renewables

The primary fuel source for nuclear fusion is:

1. Uranium
2. Carbon
3. Plutonium
4. Lead
5. Hydrogen

What alternative energy technologies deserve greater attention and investment in the future?

(Mark all that apply)

1. Hydrothermal
2. Solar
3. Wind
4. Biofuel
5. Hydrogen fuel
6. Hydroelectric
7. Nuclear Fission
8. Nuclear Fusion

Sustainability

Do you support or oppose this statement: "Sustainability is an important issue that deserves the attention of citizens and policymakers"

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose increasing redemption value taxes on plastic bottles?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Do you support or oppose banning plastic bags at the national level?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Plastic is made primarily from:

1. Cellulose
2. Rubber
3. Oil
4. Keratin
5. Wood

Which of the following is currently the greatest Ozone-Depleting Substance?

1. Carbon Dioxide
2. Methane
3. Sulfuric Acid
4. Nitrous Oxide
5. Carbonic Acid

Nuclear Energy (These questions are solely to guide future research)

Do you support or oppose increasing government spending and investment in nuclear energy?

1. Strongly Oppose
2. Somewhat Oppose
3. Neutral
4. Somewhat Support
5. Strongly Support

Briefly describe your opinions of Nuclear Energy:

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