

# American Adolescents' Responses to NASA's Climate Change Website



GEORGE MASON UNIVERSITY  
CENTER for CLIMATE CHANGE  
COMMUNICATION

# *American Adolescents' Responses to NASA's Climate Change Website*

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## Introduction

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This is the second of two reports about American adolescents and climate change. In the first report, we described teens' knowledge, attitudes, and sources of climate change information. In this report, we analyze their responses to one important source of this information – the NASA website *climate.NASA.gov*.

The NASA website is one of the primary sources provided by the federal government to inform the public on the issue of climate change. In this report we assess how adolescents feel about the website, how it affects their climate change knowledge and attitudes, and whether some adolescents are more responsive to the website than others, based on their age, gender and interest in science.

The data for the report were gathered in May, 2018, using an online survey with roughly equal numbers of 13-to-18-year-olds ( $n=1,257$ ). The survey's design included a visit to the NASA climate change website, *climate.nasa.gov*, and a split sample: adolescents were randomly assigned to one of two groups, answering half of the knowledge and attitude questions before their website visit and half of these questions afterwards. See the methods section on page 23 for more details.

## Results Summary

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### Information Search and Website Reactions

- After searching the NASA website, more than eight in ten adolescents said they found at least a moderate amount of information on a question they had about climate change (85%), and more than nine in ten said their question was answered at least partially (93%).
- Majorities said they found the site very interesting (62%), very clear (59%) and very useful (57%). Six in ten said they would probably or definitely visit the site again on their own time (61%), and two-thirds said they would be very likely to use the site if they were assigned a project on climate change at school.
- Over 70 percent of the teens rated the website positively on 14 questions about the website's design and functionality. They said they trust the site, find it attractive, easy to use and understand, and – perhaps most importantly for an informal learning website – they enjoyed looking at the website, making it more likely that they'll visit it on their own time.
- Older adolescents found the information at the website more interesting ( $p \leq .01$ ), and clearer than younger adolescents ( $p \leq .05$ ). They were also more likely to say they would visit the site again ( $p \leq .05$ ).



- Males found the information at the website more interesting ( $p \leq .01$ ), and they found more information at the website on their questions ( $p \leq .001$ ) than females. They were also more likely to say they would visit the website again ( $p \leq .01$ ).
- Teens who enjoy science classes at school rated the website more positively than those who are less interested in the subject. They found the information at the website more interesting ( $p \leq .001$ ); said the information was clearer ( $p \leq .001$ ) and more useful ( $p \leq .01$ ); and they were more likely to say they would visit the website again ( $p \leq .001$ ), as compared to those with less interest in science.

### Learning

- Teens who visited the website had significantly higher certainty that climate change is happening than those who hadn't visited the site. However, recognition that climate change is being caused by human activities was no higher among teens who had visited the website.
- Adolescents who visited the website were more aware that the level of CO<sub>2</sub> in the atmosphere is at a historic high ( $p \leq .001$ ), and that greenhouse gases hold heat around Earth ( $p \leq .01$ ), as compared to those who had not visited the site.
- Understanding of the impacts of climate change was significantly higher among the teens who had visited the website for five types of impact (increased global temperatures; glaciers, ice sheets and sea ice melting; extreme weather increasing; warmer oceans; and oceans becoming more acidic), as compared to those who hadn't visited the site. Visitors were 15 percentage points more likely to understand that climate change is warming the oceans ( $p \leq .001$ ), and nine percentage points more likely to understand that temperatures are rising and the ocean is becoming more acidic ( $p \leq .001$  for both).
- Teens who had visited the website made significantly higher estimates of the proportion of climate scientists who recognize that human-caused climate change is happening ( $p \leq .05$ ).
- The amount website visitors learned did not differ by age, gender, or interest in science. Hence, the website appears to be equally effective in educating these groups.

### Concern, Risk Perceptions, and Response Efficacy

- Teens who had visited the NASA website were more worried about climate change ( $p \leq .01$ ) than those who hadn't visited. The proportion who said they're "very worried" was seven percentage points higher among those who had visited the site (23% vs. 30%).
- Perceptions that future generations will be harmed by climate change were significantly higher among teens who had visited the NASA website ( $p \leq .05$ ), as compared to those who hadn't visited the site, and the perception that they will be personally harmed was slightly higher among adolescents who had visited the website ( $p \leq .10$ ).



- Prior to visiting the website, older adolescents were more likely than younger teens to be worried about climate change, and to say the issue is personally important. Visiting the website had a greater impact on younger teens, such that their views of the issue as personally important and worrisome increased more than older adolescents' views did. Thus, they tended to catch up to the levels of concern among older adolescents, in response to visiting the website.



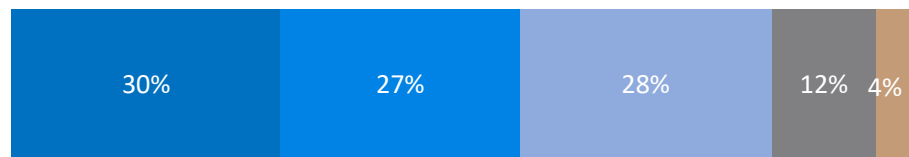
# I. Reactions to the NASA Climate Change Website

## Success in Finding Information

Prior to visiting the NASA climate change website, adolescents were asked to specify the question they would most like to ask an expert on climate change.<sup>1</sup> They were then sent to *climate.nasa.gov* and asked to browse the website and search for the answer to their question.

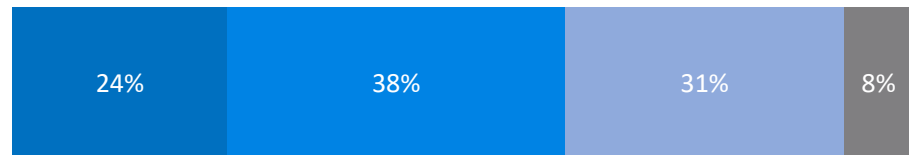
Of the teens who said they had a question about climate change, more than eight in ten said they'd found at least a moderate amount on information on their question (85%), and more than nine in ten said their question was answered at least partially (93%).<sup>2</sup>

*How much information did you find on NASA's website about your*



■ A great deal ■ A lot ■ A moderate amount ■ A little ■ None at all

*Did the information on NASA's website fully answer your question?*



■ Yes, fully ■ Yes, mostly ■ Yes, partially ■ No, not at all

*n*=1,257

<sup>1</sup> For a description of the teens' questions about climate change, see the first report from this survey, *American Adolescents' Knowledge, Attitudes and Sources of Information on Climate Change*. Available at: <https://www.climatechangecommunication.org/>

<sup>2</sup> Four percent of the adolescents said they had no questions about climate change. They are excluded from this analysis.



## Overall Reactions to the Website

Majorities said they found the site very interesting (62%), very clear (59%), and very useful (57%) Six in ten said they would probably or definitely visit the site again on their own time (61%), and two-thirds said they would be very likely to use the site if they were assigned a project on climate change at school.

Very few teens chose negative responses option on any of the measures – close to the proportion of respondents who said they don't believe climate change is happening (6%; see page 11). For the vast majority of the adolescents, the website was rated very positively.

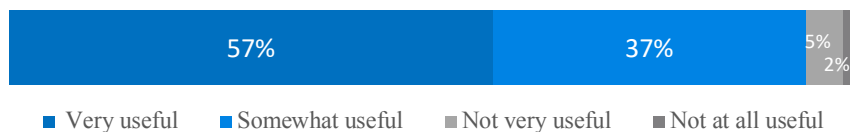
*How interesting did you find the information on the pages you visited?*



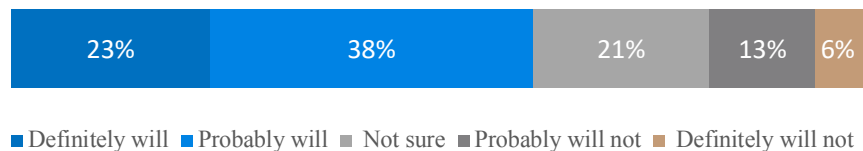
*How clear did you find the information on the pages you visited?*



*How useful did you find the information on the pages you visited?*



*How likely would you be to visit the website on your own time?*



*If you were assigned a project on climate change at school, how likely would you be to use this website for your assignment?*



n=1,257





### ❖ Reactions of Adolescents Seeking Different Types of Information<sup>3</sup>

Teens who had questions about solutions to climate change gave the website higher ratings, while those who had no questions about climate change responded more negatively. Those who asked questions about solutions:

- Found the information at the website to be more interesting ( $p \leq 001$ );
- Thought the information was clearer ( $p \leq 01$ ), and more useful ( $p \leq 001$ );
- Said they found more information about their question ( $p \leq 001$ );
- Were more likely to say they would visit the website again ( $p \leq 001$ ); and
- Were more likely to say they'd use the website for school projects ( $p \leq 001$ ).

However, adolescents who said the website fully answered their question were more likely to have asked about the reality and causes of climate change ( $p \leq 001$ ).

	Top Question Category				
	Reality	Causes	Impacts	Solutions	Other
Did the information on NASA's website fully answer your question?	2.95	2.85	2.78	2.63	2.67

Scale: 1=no, not at all; 2=yes, partially; 3=yes, mostly; 4=yes, fully

### ❖ Group Differences in Reactions to the Website

- Older adolescents found the information at the website more interesting ( $p \leq 01$ ), and clearer ( $p \leq 05$ ) than younger adolescents. They were also more likely to say they would visit the site again ( $p \leq 05$ ).
- Males found the information at the website more interesting ( $p \leq 01$ ), and they found more information at the website on their questions ( $p \leq 01$ ), than females. They were also more likely to say they would visit the website again ( $p \leq 001$ ).
- Teens who enjoy science classes at school responded to the website more positively than those who don't.<sup>3</sup> They were more likely to say:
  - They found the information at the website interesting ( $p \leq 001$ ); clear ( $p \leq 001$ ); and useful ( $p \leq 01$ );
  - They would visit the website again ( $p \leq 001$ ), and use it for school ( $p < .05$ );
  - They found information on their question ( $p \leq 05$ ), and it was fully answered ( $p \leq 05$ ).

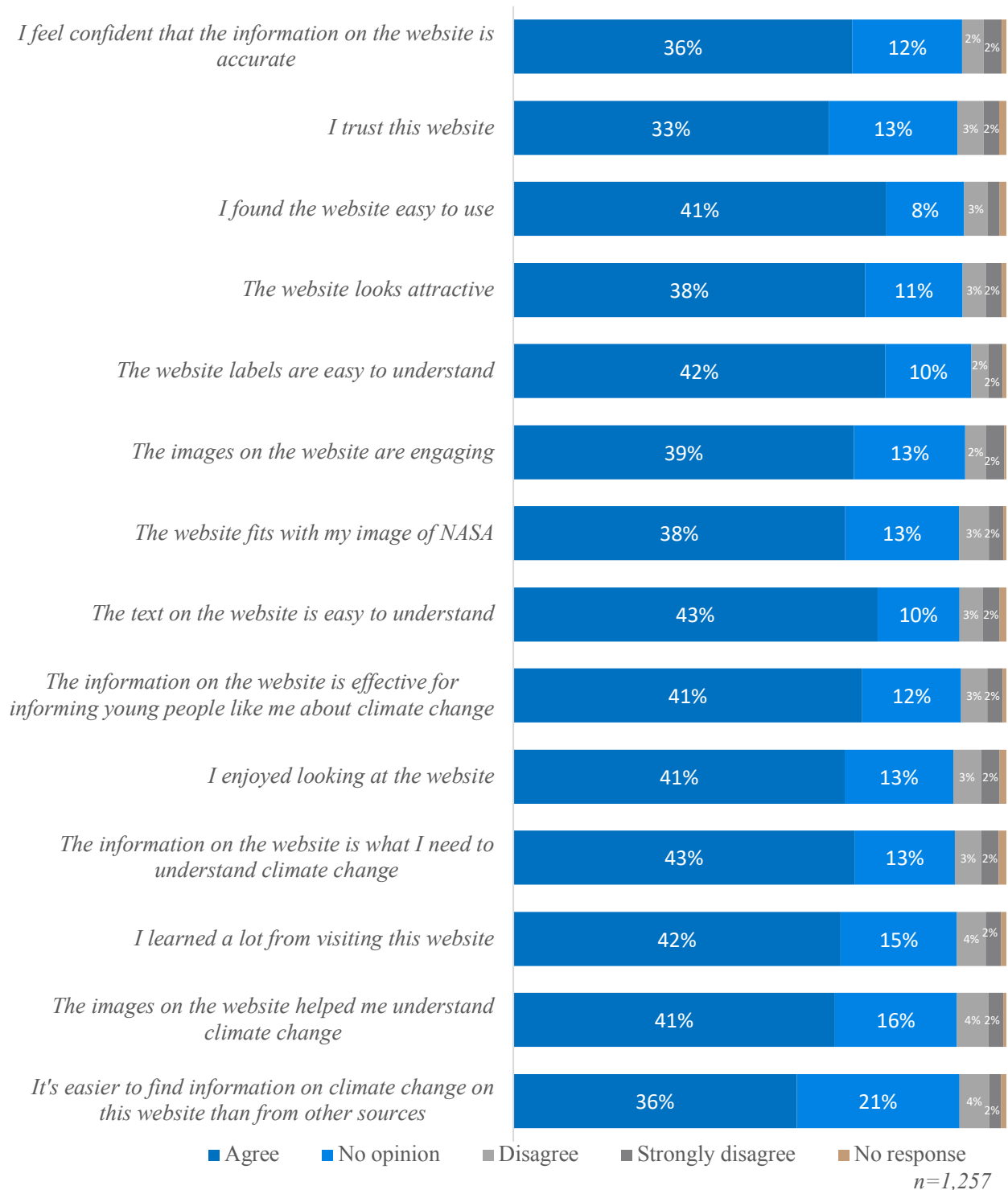
<sup>3</sup>A description of the testing methods used in this and in subsequent sections of the report is provided in the Methods section on page 24. Full results are available upon request.

<sup>3</sup> Interest in science classes was assessed by asking the teens to rate eight school classes from favorite to least favorite. The eight classes ranked were English, Math, Science, Social Studies, Music, Art, Foreign Languages, and Physical Education (P.E.).



## Evaluations of the Design and Functioning of the Website

On every evaluative dimension, over 70 percent of the teens rated the website positively. They said they trust the site, find it attractive, easy to use and understand, and – perhaps most importantly for an informal learning website – they enjoyed looking at the site, making it more likely that they’ll visit the site on their own time.



## ❖ Evaluations by Adolescents Seeking Different Types of Information

Evaluations of the website varied by the type of information the adolescent was seeking. The teens who rated the site most highly were interested in climate change solutions, or had “other” questions, (which included questions about NASA research and questions the teens wrote themselves). Those who had no questions gave the site lower ratings.

Mean Evaluations of the Website, by Type of Information Sought***						
Total	Reality	Causes	Impacts	Solutions	Other	No questions
4.19	4.14	4.12	4.21	4.31	4.32	3.49

\*\*\* $p \leq 001$

Note: The means represents the average response given on the 14 ratings of specific dimensions of the website;  $\alpha$ . EvaluationIndex = .95. Scale: 1=strongly disagree; 2=disagree; 3=no opinion; 4=agree; 5=strongly agree.

## ❖ Group Differences in Evaluations of the Website

- Age is unrelated to evaluations of the website.
- Gender is unrelated to evaluations of the website.
- Adolescents who said science is one of their two favorite classes at school evaluated the website more positively ( $p \leq 001$ ).

Mean Evaluations of the Website, by Ranking of Science Classes as “Favorite”***			
Total	First or Second	Third or Fourth	Five to Eighth
4.19	4.31	4.11	4.14

\*\*\* $p \leq 001$

Note 1: Interest in science classes was assessed by asking the teens to rate eight school classes from favorite to least favorite. The eight classes ranked were English, Math, Science, Social Studies, Music, Art, Foreign Languages, and Physical Education (P.E.).

Note 2: The means represent the average response given on the 14 ratings of specific dimensions of the website;  $\alpha$ . EvaluationIndex = .95. Scale: 1=strongly disagree; 2=disagree; 3=no opinion; 4=agree; 5=strongly agree.



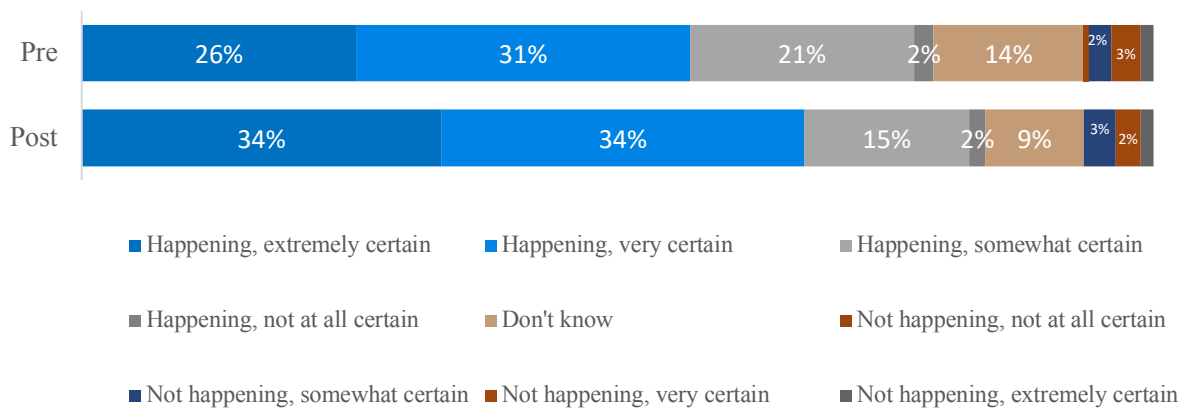
## II. Impacts of the NASA Website on Adolescents’ Climate Change Knowledge

To assess the effects of visiting the website on adolescents’ climate change knowledge, attitudes and beliefs, we split the questions into two groups, with each group answering half the questions prior to their visit and half following it.<sup>4</sup> See page 23 for detail.

### Recognition that Climate Change Is Happening

Teens who visited the website had significantly higher certainty that climate change is happening; the proportion that were “extremely sure” or “very sure” climate change is happening was 11 percentage points higher among the group that had visited the website, as compared to those who had not visited the site ( $p \leq 01$ ).

*Is climate change happening? How sure are you?*



*n*=1,257

*Full Question Wording: Responses to two questions were combined: (1) “Climate change refers to the idea that the world’s average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world’s climate may change as a result. What do you think: Do you think that climate change is happening?” [Yes; No; Don’t know]; (2) “How sure are you that climate change is/is not happening?” [Extremely sure; very sure; somewhat sure; not at all sure].*

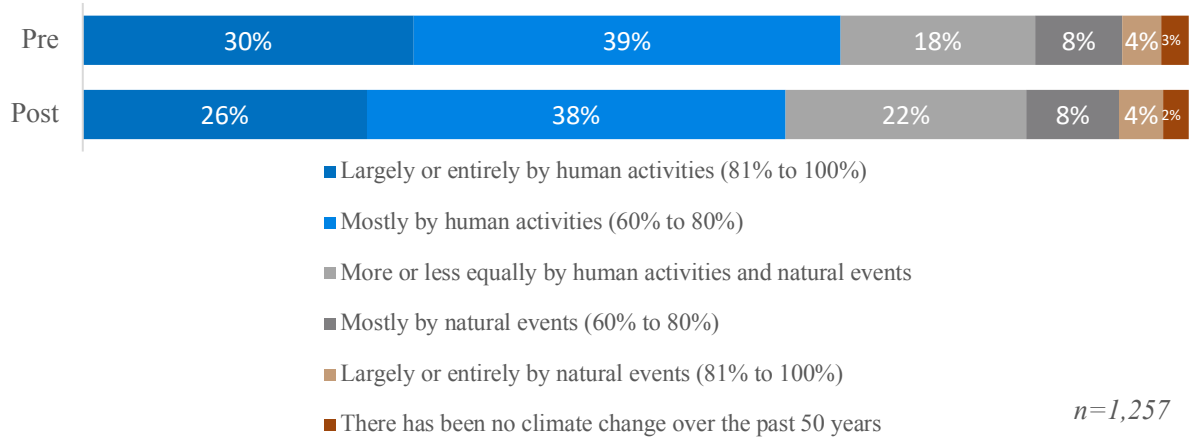
<sup>4</sup>These comparisons are based on a brief visit to the site of ten minutes, at most, and the median response time spent at the site was less than six minutes. The results may not, therefore, reflect the site’s full impact on visitors who remain as long as they like. Conversely, it may be that those who do not accept climate science may have dropped out of the survey when asked to visit the site, so some group differences may be affected by this differential. We can’t test this possibility, but in our adult NASA survey, we were able to compare those who dropped out of the study to those who completed it, and found no evidence of a differential drop-off (see Myers, Roser-Renouf, & Maibach, 2020). Therefore, we have reason to believe that it isn’t a significant influence on the findings.



## Awareness that Human Activities Are Causing Climate Change

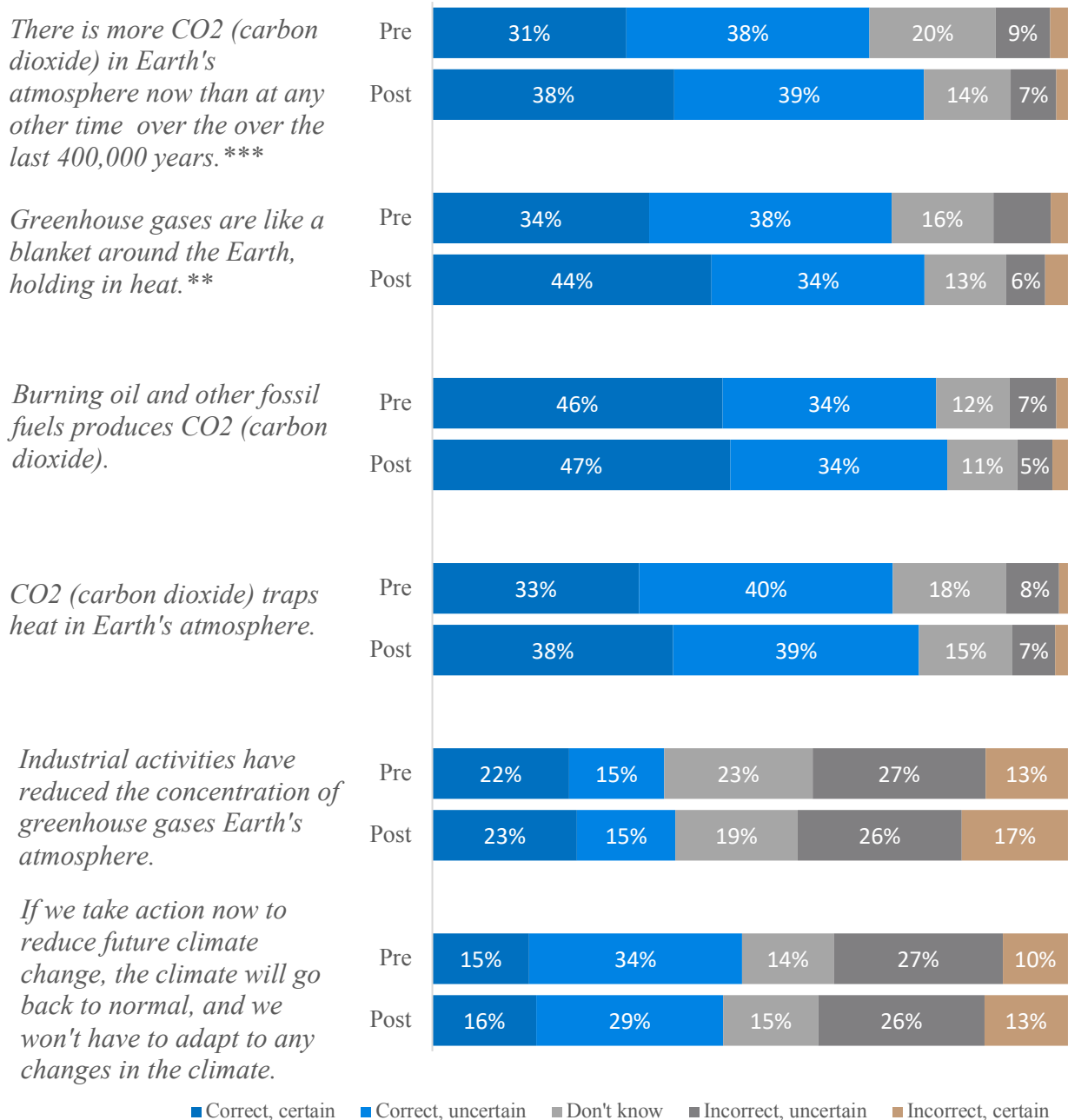
Recognition that climate change is being caused by human activities was no higher among teens who had visited the website.

*Assuming climate change is happening, do you think that any climate change has occurred over the past 50 years has been caused by...*



## Understanding of the Science Underlying Climate Change

Adolescents who visited the website were more aware that the level of CO<sub>2</sub> in the atmosphere is at a historic high, and that greenhouse gases hold heat around the Earth, as compared to those who had not visited the website.



=1,257

\*\* $p \leq 01$ ; \*\*\* $p \leq 001$

Note: Survey response options were: Definitely true; Probably true; Don't know; Probably false; and Definitely false." Because some statements are false, questions have been recoded to facilitate interpretation: Correct, certain; Correct, uncertain; Don't know; Incorrect, uncertain; and Incorrect, certain.



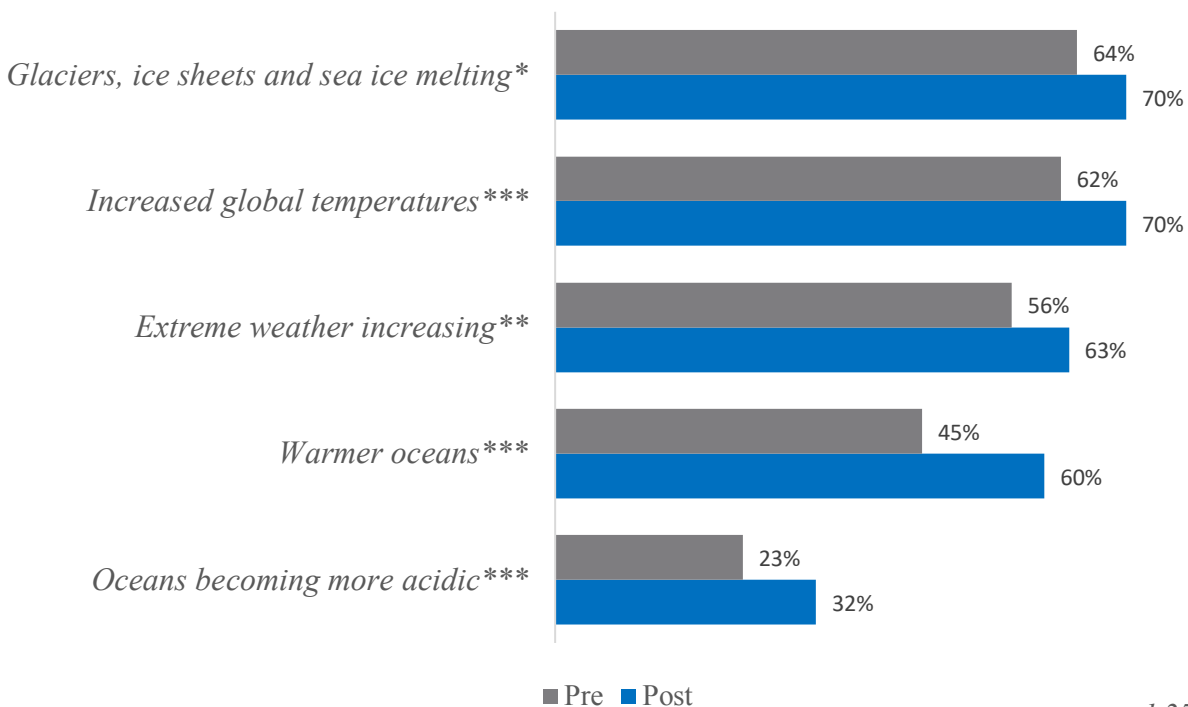
Those who had visited the site were slightly more likely to understand that CO2 traps heat in Earth’s atmosphere ( $p \leq 10$ ), but they were not more aware that burning fossil fuels produces CO2; however, awareness of these facts was already quite high among teens. Prior to the site visit, close to three-quarters of adolescents already understood these facts, making it less likely that the website visit would increase awareness significantly.

## Understanding of the Impacts of Climate Change

Understanding of the impacts of climate change was significantly higher among the teens who had visited the website for all five types of impacts assessed, as compared to those who had not yet visited the site. Visitors were 15 percentage points more likely to understand that climate change is warming the oceans, and nine percentage points more likely to understand that temperatures are rising and the ocean is becoming more acidic.

Adolescents who had visited the website identified 2.96 correct impacts on average, out of five possible, compared to 2.50 impacts among those who had not visited the site ( $p \leq 001$ ).

*Which of the following are evidence that climate change is happening? (Check all that apply.)*



\*\* $p \leq 01$ ; \*\*\* $p \leq 001$



## **Awareness of the Scientific Consensus on Climate Change**

Teens who had visited the website made significantly higher estimates of the proportion of climate scientists who recognize that human-caused climate change is happening. Prior to visiting the site, the average proportion estimated was 70.5%; following the site visit, the proportion was 72.9% ( $p \leq 0.05$ ).

## **Group Differences in Learning from the NASA Website**

No group differences in learning were identified. The amount website visitors learned did not differ by:

- ❖ Age;
- ❖ Gender; or
- ❖ Interest in science.

Hence, the website appears to be equally effective at educating adolescents within these groups.



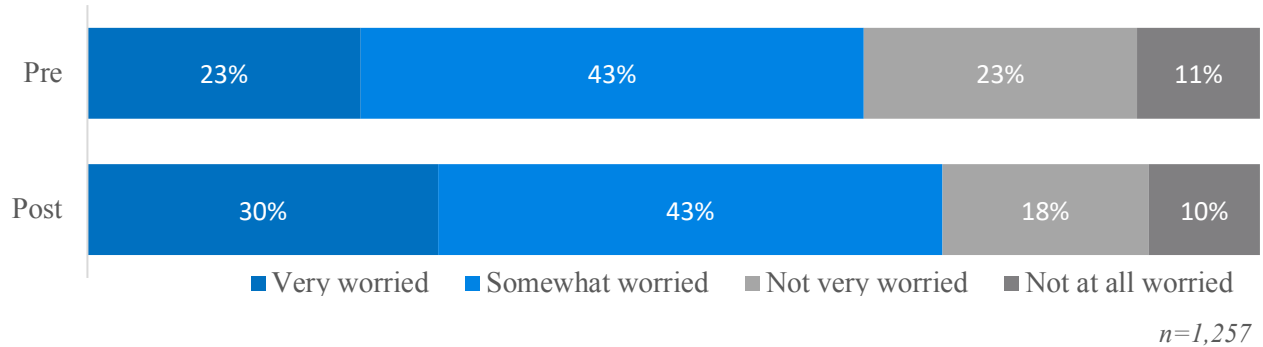


### III. Impacts of NASA’s Website on Adolescents’ Concern, Risk Perceptions, and Response Efficacy

#### Worry and Personal Importance of Climate Change

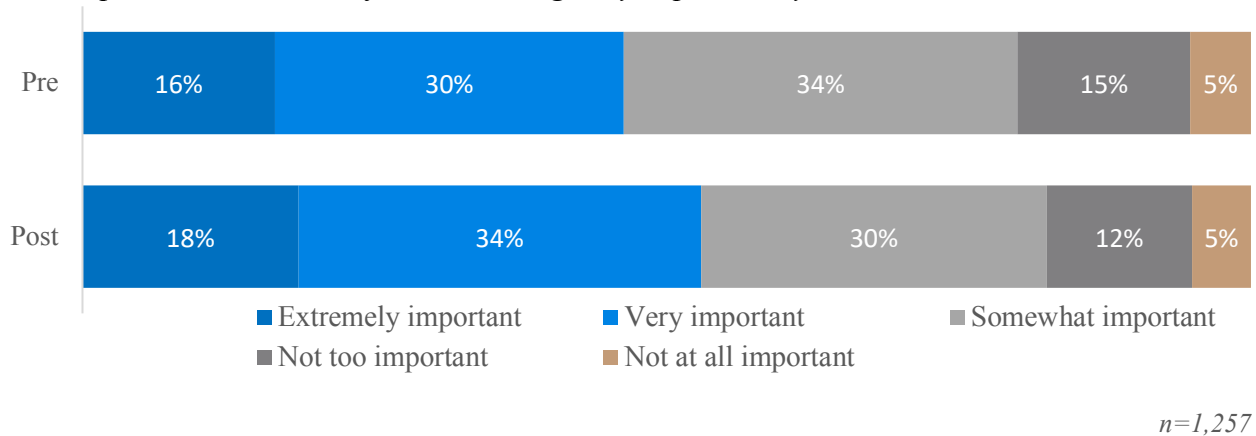
Adolescents who had visited the NASA website were more worried about climate change than those who hadn’t ( $p \leq 01$ ). The proportion who said they’re “very worried” was seven percentage points higher among those who had visited the website.

*How worried are you about climate change?*



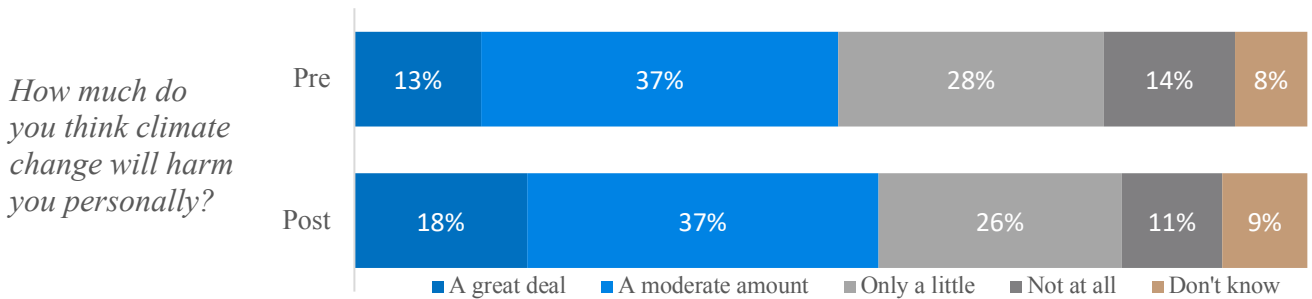
Adolescents who had visited the website were slightly more likely to say the issue was personally important ( $p \leq 10$ ). The proportion who said the issue was “extremely” or “very” important was six percentage points higher among those who had visited the website.

*How important is the issue of climate change to you personally?*

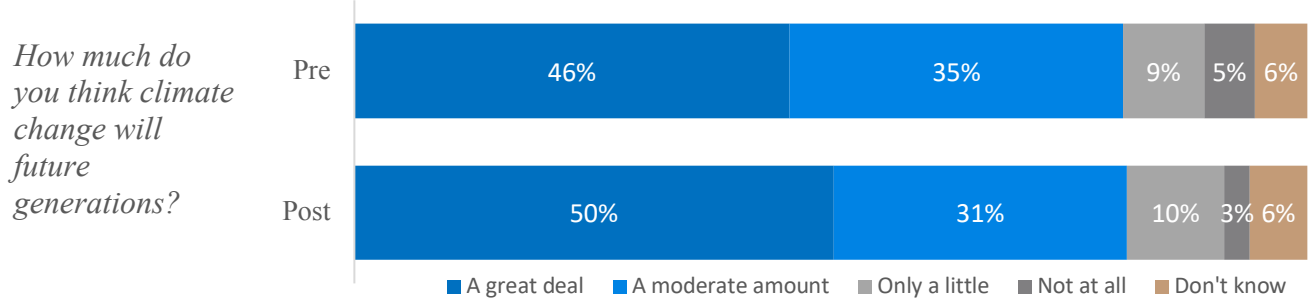


## Perceptions of the Harm Climate Change Will Cause to Them Personally and to Future Generations

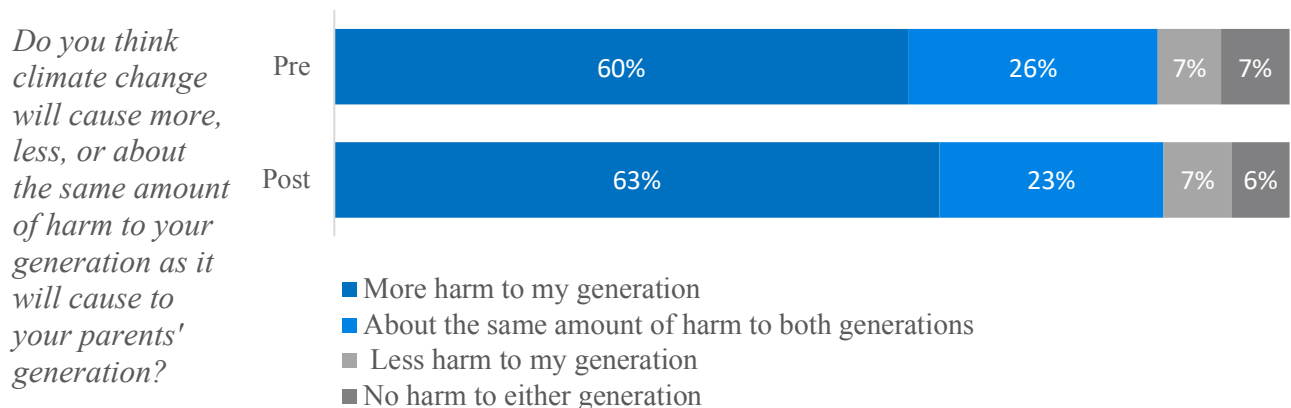
The perception that climate change will harm them personally was slightly higher among adolescents who had visited the website ( $p \leq .10$ ), with a difference of five percentage points in perceptions they will be harmed “a great deal” between those who had and had not visited the website.



Perceptions that future generations will be harmed by climate change were significantly higher among teens who had visited the NASA website, as compared to those who hadn't ( $p \leq .05$ ).



The expectation that their generation will experience either more or less harm from climate change than their parents' generation was not affected by visiting the website.

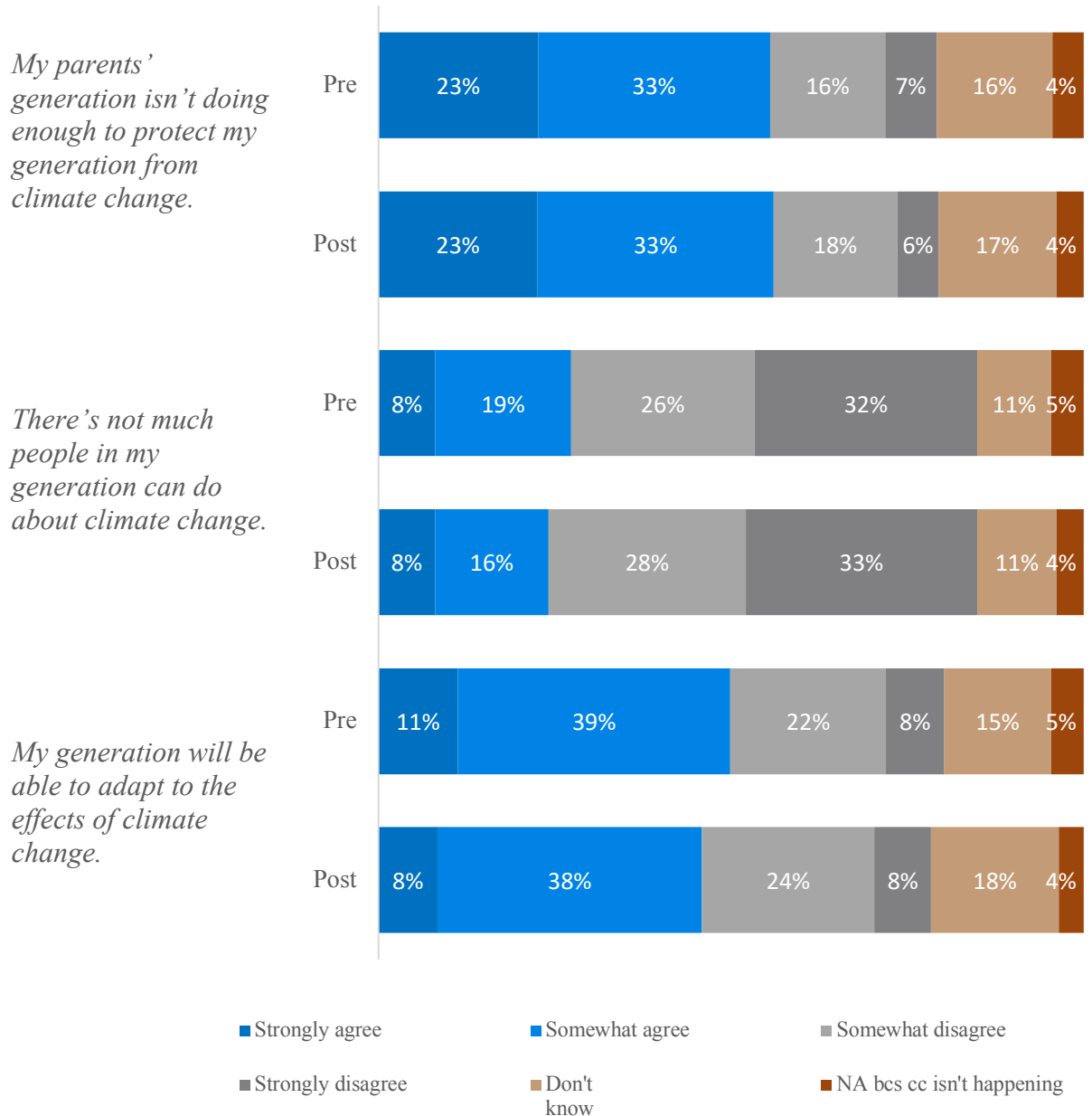


$n=1,257$



## Perceptions of the Efficacy of Their Parents' and Their Own Generation's Responses to Climate Change

Beliefs about their own generation's response to climate change, and their parents' generation's responses, were not affected by visiting the website.



## Group Differences in Changes to Concern, Risk Perceptions, and Response Beliefs

- ❖ Prior to visiting the website, older adolescents were more likely to be worried about climate change, and to say the issue was personally important. Visiting the website had a greater impact on younger teens, such that their views of the issue as personally important increased more than older adolescents did ( $p \leq .01$ ) and their level of worry tended to increase more ( $p \leq .10$ ). Thus, they tended to catch up to the levels of concern among older adolescents.

Personal Importance of Climate Change by Age and Website Visit						
	Age					
	13	14	15	16	17	18
Pre	3.06	3.26	3.36	3.32	3.58	3.64
Post	3.45	3.57	3.48	3.57	3.31	3.52

Scale: 1=not at all important; 2=not too important; 3=somewhat important; 4=very important; 5=extremely important

Risk perceptions and response beliefs did not follow the same pattern; i.e., the perceptions of one age group were not changed more than other age groups.

- ❖ Gender was unrelated to changes in concern, risk perceptions or responses beliefs; males and females were equally impacted by the website visit.
- ❖ Interest in science was not related to changes in concern, risk perceptions or responses beliefs; teens were equally impacted by the website visit, regardless of how much they enjoy learning about science at school.



## IV. Sample Characteristics

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<b>Demographics</b>		
<b>Age</b>	<b>Percent</b>	<b>Frequency</b>
. 13	16.7	210
. 14	16.7	210
. 15	16.7	210
. 16	16.7	210
. 17	16.7	210
. 18	16.7	210
<b>Grade</b>	<b>Percent</b>	<b>Frequency</b>
. 9th	39.3	495
. 10th	18.4	232
. 11th	16.3	205
. 12th	21.6	272
. Not attending school	4.1	52
. No response	0.3	4
<b>Gender</b>	<b>Percent</b>	<b>Frequency</b>
. Male	50.3	634
. Female	49.0	617
. Prefer to self-describe	0.7	9
<b>Race/Ethnicity</b> <i>(multiple responses allowed)</i>	<b>Percent</b>	<b>Frequency</b>
. Asian	12.3	155
. Black or African American	21.1	266
. Hispanic/Latino	15.7	198
. Native American or Alaskan Native	2.7	34
. Native Hawaiian or Pacific Islander	1.0	13
. White	64.8	816
. Other	5.1	64
. Prefer not to answer	0.8	10



Grades	Percent	Frequency
. As and Bs	72.2	910
. Bs and Cs	22.6	285
. Cs and Ds	3.4	43
. I'm not going to school	1.7	21

School Subjects, Ranked by Preference		
<i>How much do you like each of the following subjects at school? (1=favorite; 8=least favorite)<sup>a</sup></i>	Mean	SE
. Science	3.75	0.06
. Art	4.30	0.07
. English	4.34	0.06
. Music	4.36	0.07
. Math	4.40	0.07
. Social studies	4.58	0.06
. P.E. (Physical Education)	4.80	0.07
. Foreign languages	5.49	0.06

Full question text: “How much do you like each of the following subjects at school? Please rank the subjects from “1” for your favorite subject to “8” for your least favorite subject. Drag your favorite subject to the top of the list, your second-favorite subject to the line below your favorite class, and so on. Even if you're not going to school now, please rank the subjects, based on the feelings you had when you were attending school.”



<b>Career Aspirations</b>		
<i>How much do you think you would enjoy a career as a scientist?</i>	Percent	Frequency
. I would enjoy it a lot	25.8	325
. I would kind of enjoy it	34.9	440
. I don't know	19.8	249
. I would not enjoy it very much	11.7	148
. I would not enjoy it at all	7.6	96
. No response	0.2	2
<i>Even if you're not sure, what do you think you'll do after high school?</i>	Percent	Frequency
. Get a job	10	126
. Attend a community college	15.5	195
. Attend a 4-year college or university	59.7	752
. Join the military	3.2	40
. Learn a trade/skill, like car repair	2.4	30
. Go into business for myself	1.8	23
. Other	2.1	26
. I have no idea what I'll do	5.2	66
. No response	0.2	2



## VI. Methods

### Design

In May of 2018, we surveyed American adolescents, ages 13-18, using the online sample provider, Qualtrics. The survey was fielded May 15 - May 31; 1,260 adolescents responded, but three invalid participants have been dropped from the sample because they failed to visit the NASA website, for a final N of 1,257. The sample contains roughly equal number of respondents of each age, and has a margin of error of three percentage points.

The survey included a visit to the NASA climate change website, *climate.nasa.gov*. Prior to visiting the site, participants were asked where they obtain information about climate change, what types of news they follow, and what question they would most like to ask a climate expert. They were then instructed to search for the answer to their question at NASA's website. They were required to spend a minimum of four minutes browsing the site. The median time spent at the site was five minutes, 53 seconds. When they were finished browsing the site, they returned to the survey and answered a series of questions to regarding the success of their information search, and their reactions to the website.

A series of knowledge and attitude questions were included in the survey. The participants were randomly assigned to one of two groups, and each group answered half of the knowledge and attitude questions before they visited the website, and half after the site visit (the number of questions was equivalent in each quadrant). The design is shown below:

Survey Design		
Questions Asked of Both Groups Prior to the Site Visit	<ul style="list-style-type: none"> <li>• Favorite School Subjects</li> <li>• Career Aspirations</li> <li>• Types of News Followed</li> <li>• Where They Find Information about Climate Change</li> <li>• Top Question to Ask an Expert about Climate Change</li> </ul>	
	Group 1	Group 2
Questions Asked of Only One Group Prior to the Site Visit	<ul style="list-style-type: none"> <li>• Science Underlying Climate Change</li> <li>• Impacts of Climate Change</li> </ul>	<ul style="list-style-type: none"> <li>• Certainty Climate Change is Happening</li> <li>• Cause of Climate Change</li> <li>• Concern, Perceived Risk, and Response Efficacy</li> <li>• Consensus Estimate</li> </ul>
Questions Asked of Only One Group After Site Visit	<ul style="list-style-type: none"> <li>• Certainty Climate Change is Happening</li> <li>• Cause of Climate Change</li> <li>• Concern, Perceived Risk, and Response Efficacy</li> <li>• Consensus Estimate</li> </ul>	<ul style="list-style-type: none"> <li>• Science Underlying Climate Change</li> <li>• Impacts of Climate Change</li> </ul>
N	600	657





## Analysis Methods

The significance testing in this report is based on analysis-of-variance and chi-square tests. Tests are summarized briefly below. Full results are available upon request.

- ❖ *Overall reactions to the website by adolescents seeking different types of information:* In a series of analysis-of-variance tests, evaluations of the website were treated as the dependent variables, and the type of question the adolescent asked was the independent variable. The types of question asked were: (1) is climate change real? (2) what causes climate change? (3) what are the impacts of climate change? (4) can we solve climate change? (5) Other questions; (6) No questions.
- ❖ *Overall reactions to the website by adolescents in different groups:* In a series of analysis-of-variance tests, evaluations of the website were treated as the dependent variables. The independent variables were: (1) Age (13-18); (2) Gender (Male/Female); and (3) Ranking of science classes at school (1<sup>st</sup> or 2<sup>nd</sup>; 3<sup>rd</sup> or 4<sup>th</sup>; 5<sup>th</sup> to 8<sup>th</sup>).
- ❖ *Evaluations of the website's design and functioning by adolescents seeking different types of information:* The 14 measures used for evaluating the website's design and functioning were combined into an index that averaged the 14 measures ( $\alpha_{EvaluationIndex} = .95$ ). This index was treated as the dependent variable, and the type of question the adolescent asked was the independent variable. The types of question asked were: (1) is climate change real? (2) what causes climate change? (3) what are the impacts of climate change? (4) can we solve climate change? (5) Other questions; (6) No questions.
- ❖ *Evaluations of the website's design and functioning by adolescents in different groups:* The 14 measures used for evaluating the website's design and functioning were combined into an index that averaged the 14 measures ( $\alpha_{EvaluationIndex} = .95$ ). This index was treated as the dependent variable. The independent variables were: (1) Age (13-18); (2) Gender (Male/Female); and (3) Ranking of science classes at school (1<sup>st</sup> or 2<sup>nd</sup>; 3<sup>rd</sup> or 4<sup>th</sup>; 5<sup>th</sup> to 8<sup>th</sup>).
- ❖ *Impacts of the website visit on recognition that climate change is happening and caused by humans:* Analysis-of-variance tests were used to assess whether adolescents who had visited the NASA website were significantly more certain that climate change is happening and caused by humans than adolescents who had not yet visited the site.
- ❖ *Impacts of the website visit on understanding of the science underlying climate change:* Analysis-of-variance tests were used to assess whether adolescents who had visited the NASA website had significantly higher understanding of climate science on each of the six measures.
- ❖ *Impacts of the website visit on understanding of the impacts of climate change:* Chi-square tests were used to assess whether adolescents who had visited the NASA website had significantly higher awareness of each of the five impacts of climate change. To assess overall awareness of climate change impacts, the number of impacts correctly identified were summed. An analysis-of-variance test was used to assess whether adolescents who had visited the website identified a significantly higher number of impacts correctly.



- ❖ *Impacts of the website visit on awareness of the scientific consensus on climate change:* An analysis-of-variance test was used to assess whether adolescents who had visited the website made significantly higher estimates of the level of scientific consensus.
- ❖ *Group differences in learning from the NASA website:* Two-way analysis of variance tests were used to identify any interactions between the website visit and group membership. The independent variables were:
  - website visit; and
  - group (age, gender and interest in science were tested separately).  
The dependent variables were knowledge measures:
    - certainty climate change is happening;
    - awareness that it is caused by humans;
    - understanding of climate science (mean of six measures);
    - awareness of impacts (number of correct impacts identified); and
    - estimated level of the scientific consensus.
- ❖ *Impacts of the website on worry and personal importance:* Analysis-of-variance tests were used to assess whether adolescents who had visited the website were significantly more worried or viewed the issue of climate change as more personally important.
- ❖ *Impacts of the website on perceptions of the harm climate change will cause:* Chi-square tests were used to assess whether adolescents who had visited the website were significantly more likely to think they would personally be harmed; future generations would be harmed; or their generation would be harmed more than their parents' generation.
- ❖ *Impacts of the website on perceptions of the efficacy of their parents' and their own generation's responses to climate change:* Chi-square tests were used to assess whether adolescents who had visited the website differed significantly from those who hadn't in their perceptions of the efficacy of responses to climate change by their parents' and their own generation.
- ❖ *Group differences in changes to concern, risk perceptions and response beliefs:* Two-way analysis-of-variance tests were used to identify interactions between website visit and group. The independent variables were:
  - website visit; and
  - group (age, gender and interest in science were tested separately).  
The dependent variables were:
    - worry; and
    - personal importance.

Chi-square tests were used to assess whether the risk perceptions and response beliefs of the members of any of the groups changed significantly. Each category within each group was tested separately. E.g., to assess whether gender was a factor in perceptions of personal harm from climate change, we compared the pre-post site-visit means of males and females separately.



## VII. Questionnaire

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### Start of Block: Consent

This survey is for American teens. We'd like to ask you about your interests and beliefs, and about a current issue you may have been hearing about from news and people you know. We'll also ask you to visit a website, and then tell us what you think about it.

*Please read the following information and indicate whether you agree to be part of the study.*

**RISKS:** There are no foreseeable risks from participating in this study. You have the right to withdraw at any time and you do not have to answer any question that you do not wish to answer on the survey.

**BENEFITS:** Your answers will help us reach teens with information that can be useful to people your age.

**CONFIDENTIALITY:** The data in this study will be private. We won't know your name, and we won't share your answers with anyone.

**PARTICIPATION:** Your participation is voluntary, and you may withdraw from the study at any time and for any reason. There are no costs to you or any other party for participation.

**CONTACT:** This research is being conducted by Drs. Connie Roser-Renouf at George Mason University. Should you wish to contact Dr. Roser-Renouf, you may get in touch with her through email at: [croserre@gmu.edu](mailto:croserre@gmu.edu). You may contact the George Mason University Office of Research Integrity and Assurance at [irb@gmu.edu](mailto:irb@gmu.edu) if you have questions or comments regarding your rights as a participant in the research. This research has been reviewed according to George Mason University procedures governing your participation in this research.

**CONSENT:**

- Please click here if you consent to participating in this study. (1)

End of Block: Consent

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### Start of Block: Introductory Questions



Q1 First, a few questions about you, your family and your friends...

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*(randomize order of subjects)*

Q2 How much do you like each of the following subjects at school? Please rank the subjects from "1" for your *favorite subject* to "8" for your *least favorite subject*.

\_\_\_\_\_ English  
\_\_\_\_\_ Foreign languages  
\_\_\_\_\_ Social studies  
\_\_\_\_\_ Science  
\_\_\_\_\_ Art  
\_\_\_\_\_ Math  
\_\_\_\_\_ Music  
\_\_\_\_\_ P.E. (Physical Education)

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Q3 How much do you think you would enjoy a career as a scientist?

- I would not enjoy it at all
  - I would not enjoy it very much
  - I don't know
  - I would kind of enjoy it
  - I would enjoy it a lot
- 



*(randomize topics)*

Q4 How closely do you follow news about each of the following?

	Not at all	A little	Somewhat closely	Very closely
Politics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
World affairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Science and technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nature and the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Professional sports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Celebrities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fashion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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*(randomize sources)*



Q5 How often do you use each of the following as a source for news?

	Often	Sometimes	Rarely	Never
Television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Print newspapers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online newspapers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media (e.g. Facebook or Twitter)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(randomize statements)

Q6 How much do you agree or disagree with each of the statements below?

For the statements that ask about your parent, please choose *the parent that you feel closest to*, and think about that parent as you answer.

	Strongly disagree	Somewhat disagree	Don't know	Somewhat agree	Strongly agree
My parent doesn't really trust me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can tell my parent almost anything.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my family, we often talk about topics like politics and religion, where some people disagree with others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My parent often asks my opinion when the family is talking about something.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting your ideas across is important, even if others don't like it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



*(randomize questions)*

Q7 When you think about the parent you feel closest to and your closest friend, who would you say...

	Closest friend	Parent
Best understands what you think and feel	<input type="radio"/>	<input type="radio"/>
Is most interested in hearing what you think	<input type="radio"/>	<input type="radio"/>
Knows you best	<input type="radio"/>	<input type="radio"/>
Has the most influence on you	<input type="radio"/>	<input type="radio"/>
You trust the most	<input type="radio"/>	<input type="radio"/>
You rely on the most for advice	<input type="radio"/>	<input type="radio"/>
Most influences your beliefs and opinions	<input type="radio"/>	<input type="radio"/>

End of Block: Intro Qs

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## Start of Block: Introduction to Climate Change

Q8 Now we'd like to ask you some questions about *climate change*.

Climate change refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change in a number of ways as a result.

Many people call climate change "global warming," and to many people, the terms mean the same thing.

End of Block: Intro to CC

## Start of Block: Climate Change Information Sources

(randomize sources)

Q9 If each of the following were to discuss climate change, how much would you trust them as a source of information on the topic?

	Strongly trust	Somewhat trust	Somewhat distrust	Strongly distrust	Don't know
Your favorite news source	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your parents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science teachers at school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists at NASA (the National Aeronautics & Space Administration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





Q10 About how often, if ever, have you heard each of the following talk about climate change?

	Never	Rarely	Sometimes	Often	Don't know
Your favorite news source	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your parents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science teachers at school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*(Respondents who answered “never” to an information source in Q10 don’t see that source in the list on Q11.)*

Q11 Overall, how much do you agree or disagree with the things you have heard about climate change from each of the following?

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Don't know
Your favorite news source	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your parents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science teachers at school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: CC info sources



## Start of Block: Climate Change Beliefs

*Half the respondents will see this block in the pretest. The other half will see it in the post-test.*

Q12 What do you think? Do you think climate change is happening?

- Yes
- No
- Don't know

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*Display This Question:*

*If What do you think? Do you think climate change is happening? = Yes*

Q13 How sure are you that climate change is happening?

- Not at all sure
- Somewhat sure
- Very sure
- Extremely sure

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*Display This Question:*

*If What do you think? Do you think climate change is happening? = No*

Q14 How sure are you that climate change is not happening?

- Not at all sure
  - Somewhat sure
  - Very sure
  - Extremely sure
- 



*(Half the respondents see the response options in the order listed below; the other half see the reverse order.)*

Q15 Assuming climate change is happening, do you think that any climate change that has occurred over the past 50 years has been caused...

- Largely or entirely by human activities (81% to 100%)
  - Mostly by human activities (60% to 80%)
  - More or less equally by human activities and natural events
  - Mostly by natural events (60% to 80%)
  - Largely or entirely by natural events (81% to 100%)
  - There has been no climate change over the past 50 years
- 

Q16 How much do you think climate change will harm future generations of people?

- A great deal
  - A moderate amount
  - Only a little
  - Not at all
  - Don't know
- 



Q17 How much do you think climate change will harm you personally?

- A great deal
  - A moderate amount
  - Only a little
  - Not at all
  - Don't know
- 

Q18 How important is the issue of climate change to you personally?

- Not at all important
  - Not too important
  - Somewhat important
  - Very important
  - Extremely important
- 

Q19 How worried are you about climate change?

- Very worried
  - Somewhat worried
  - Not very worried
  - Not at all worried
- 



Q20 Do you think climate change will cause more, less, or about the same amount of harm to your generation as it will cause to your parents' generation?

- Less harm to my generation
- More harm to my generation
- About the same amount of harm to both generations
- No harm to either generation
- Don't know

*(randomize order of statements)*

Q21 How much do you agree or disagree with each of the following statements?

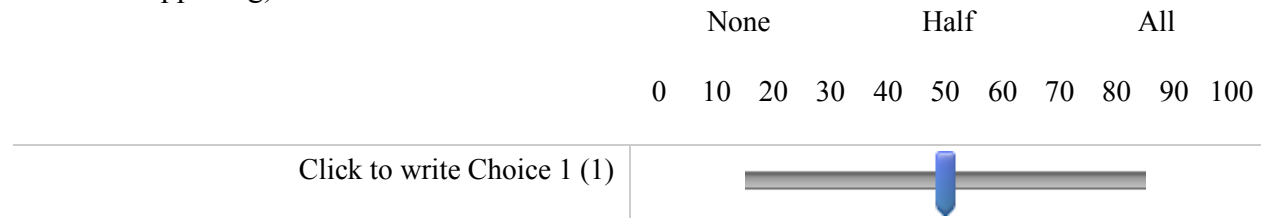
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Don't know	Not applicable because climate change isn't happening
My parents' generation isn't doing enough to protect my generation from climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My generation will be able to adapt to the effects of climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There's not much people in my generation can do about climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22 To the best of your knowledge, what percentage of climate scientists think that human-caused climate change is happening?

Please click on the slider bar below to indicate your answer. You can slide the indicator on the



bar anywhere from 0% (no climate scientists think it's happening) to 100% (all climate scientists think it's happening).



If you don't know enough to say, just click here.

Don't know (1)

End of Block: Climate Change Beliefs

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## Start of Block: Climate Change Expert Question

All respondents see this block in the pre-test.

Q23 If you had the chance, which of the following questions would you most like to ask an expert on climate change?

- Is climate change really happening?
- How do you know climate change is happening?
- What causes climate change?
- How do you know that climate change is mostly caused by human activities, not natural changes in the environment?
- What harm will climate change cause?
- What benefits will climate change have?
- Will climate change harm people?
- What can I do to reduce climate change?
- What can the United States do to reduce climate change?
- Is there still time to reduce climate change, or is it too late?
- What kind of research are you conducting on climate change?
- I don't have any questions about climate change.
- Other: \_\_\_\_\_

End of Block: Climate Change Expert Question

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## Start of Block: Knowledge Block

The respondents who *did not see* the Climate Change Beliefs block in the pre-test see this block in the pre-test & the Climate Change Beliefs block in the post-test. Respondents *who did see* the CC beliefs block in the pre-test will see this block in the post-test.

*(randomize response options)*

Q24 Which of the following are evidence that climate change is happening? (Check all that apply.)

- Increased global temperatures
  - Warmer oceans
  - Oceans becoming more acidic
  - Glaciers, ice sheets and sea ice decreasing
  - Extreme weather events increasing
  - Volcanic eruptions increasing
  - Acid rain increasing
  - Hole in the ozone layer getting bigger
  - None of the above because climate change isn't happening
- 





(randomize items)

Q25 True or false?

	Definitely true	Probably true	Probably false	Definitely false	Don't know
Burning oil and other fossil fuels produces CO <sub>2</sub> (carbon dioxide).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industrial activities have reduced the concentration of greenhouse gases in Earth's atmosphere.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Greenhouse gases are like a blanket around the earth, holding in heat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If we take action now to reduce future climate change, the climate will go back to normal, and we won't have to adapt to any changes in the climate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CO <sub>2</sub> (carbon dioxide) traps heat in Earth's atmosphere.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is more CO <sub>2</sub> (carbon dioxide) in Earth's atmosphere now than at any other time over the last 400,000 years.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Knowledge Block

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## Start of Block: Website intro

Q26 Now we'd like to show you a website designed by NASA that provides people with information on climate change. Please take up to eight minutes browsing the website.

We'd like you to look for information that answers your question (*the response to Q23 – the question the respondent would most like to ask a climate expert – is inserted here*).

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Q27 If you see a message like "The page you are on is trying to open a site in a new window," please click "Accept."

Please come back to the survey after you have browsed the website. You can leave this survey window open while you look around the website. We'll alert you after ten minutes have passed.

When you are finished browsing the website and are ready to answer a few questions, please come back to this window and click the "Next" button that will appear shortly.

**HIDE NEXT BUTTON FOR 1 MINUTE**

**TIME HOW LONG UNTIL THE RESPONDENT HITS THE "NEXT" BUTTON  
IF RESPONDENT HAS NOT CLICKED "NEXT" AFTER 10 MINUTES, POP-UP A  
REMINDER WINDOW WITH THE FOLLOWING TEXT:**

**Just as a reminder, please return to the survey when you are finished browsing the website.  
We have just a few more questions for you!**

End of Block: website intro

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## Start of Block: Website Evaluation

Q28 How interesting did you find the information on the pages you visited?

- Very interesting
  - Somewhat interesting
  - Not very interesting
  - Not at all interesting
- 

Q29 How clear did you find the information on the pages you visited?

- Not at all clear
  - Not very clear
  - Somewhat clear
  - Very clear
- 

Q30 How useful did you find the information on the pages you visited?

- Very useful
  - Somewhat useful
  - Not very useful
  - Not at all useful
- 



Q31 How likely would you be to visit the website on your own time?

- Definitely will not
  - Probably will not
  - Not sure
  - Probably will
  - Definitely will
- 

Q32 How much information did you find on NASA's website about your question (*the response to Q27 – the question the respondent would most like to ask a climate expert – is inserted here*)?

- A great deal (1)
  - A lot (2)
  - A moderate amount (3)
  - A little (4)
  - None at all (5)
- 

Q33 Did the information on NASA's website fully answer your question (*the response to Q23 – the question the respondent would most like to ask a climate expert – is inserted here*)?

- No, not at all
  - Yes, partially
  - Yes, mostly
  - Yes, fully
- 



Q34 If you were assigned a project on climate change at school, how likely would you be to use this website for your assignment?

- Very unlikely
  - Somewhat unlikely
  - Not sure
  - Somewhat likely
  - Very likely
- 



(randomize order of statements)

Q35 Now, thinking about the NASA climate change website overall, how much do you agree or disagree with each of the following statements?

	Strongly disagree	Disagree	No opinion	Agree	Strongly agree
The information on the website is what I need to understand climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The information on the website is effective for informing young people like me about climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's easier to find information on climate change on this website than from other sources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The website looks attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed looking at the website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The website fits with my image of NASA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The text on the website is easy to understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The images on the website helped me understand climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The images on the website are beautiful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the website easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident that the information on the website is accurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I trust this website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I learned a lot from visiting this website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Q36 How much do you trust the scientific research conducted by NASA on the topic of climate change?

- Strongly distrust
- Somewhat distrust
- Somewhat trust
- Strongly trust
- Don't know

End of Block: website evaluation

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### Start of Block: Demos

Q37 Finally, just a few questions about you.

---

Q38 How old are you?

- 13
  - 14
  - 15
  - 16
  - 17
  - 18
- 



Q39 What grade are you in?

- 9th
  - 10th
  - 11th
  - 12th
  - I'm not going to school
- 

Q40 Are you:

- Male
  - Female
  - Other
- 

Q41 What is your race and ethnicity?

- Non-Hispanic White
  - Non-Hispanic Black
  - Hispanic
  - Asian
  - Native American/Pacific Islander
  - Two or more of the above
  - Other \_\_\_\_\_
- 





Q42 At school, are your grades mostly...

- As and Bs
  - Bs and Cs
  - Cs and Ds
  - Not applicable
- 

Q43 Even if you're not sure, what do you think you'll do after high school?

- Get a job
  - Attend a community college
  - Attend a 4-year college or university
  - Join the military
  - Learn a trade/skill, like car repair
  - Go into business for myself
  - Other \_\_\_\_\_
  - I have no idea what I'll do
- 

Thanks for taking the time to complete this survey!

Your answers will help NASA improve their website to make it more appealing to teens like you.

End of Block: Demos

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