



MULTIMEDIA RESEARCH

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Engaging Antarctica
Front-End Evaluation



Report for
Nebraska Educational Telecommunications
University of Nebraska State Museum

by

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Photo: Tim Naish, www.andrill.org

EXECUTIVE SUMMARY
ENGAGING ANTARCTICA FRONT-END EVALUATION
MULTIMEDIA RESEARCH • MAY, 2007

As part of the International Polar Year activities, the *Engaging Antarctica* project will produce a *NOVA* PBS television show in addition to exhibits and activities for youth to increase public and student awareness and understanding about Antarctica. In collaboration with the *Engaging Antarctica* team, Multimedia Research developed a written online questionnaire to provide the project with a baseline understanding of adult and middle school students' knowledge of content associated with the project.

Our national adult sample (N = 102) is a science-attentive *NOVA*-viewing group, who is interested in the subject of Antarctica but does not feel well informed and is, on average, neutral about Antarctica's importance in their lives. Our public school 7th graders (N = 92) from California and Virginia do not feel any better informed about Antarctica than the adults but are less interested in the subject and feel Antarctica is less important to their lives. Gender does not influence either interest, knowledge or importance ratings. Both age groups expect to hear news about Antarctica most likely through television and the Internet. Adults tend to be more knowledgeable than students; specific differences are referenced in the full report.

In open-ended descriptions of Antarctica, both adults and students emphasize that Antarctica is very cold, icy, at the south pole, that penguins live there and it is a continent.

In response to a series of multiple-choice questions, we find that almost all respondents know that Antarctica is south of their home. The majority of respondents have an accurate knowledge of the animal life in Antarctica. All know that penguins live there, and three-quarters know that seals and whales live in Antarctica. However, half of respondents, mostly students, believe incorrectly that Antarctica has walrus and polar bears. Respondents are less aware of the range of geological features that exist in Antarctica. All are aware of Antarctic glaciers. Eight out of ten adults and four out of ten students know that Antarctica has mountains and valleys. Lakes are known to 41%, and volcanoes to 20%. Only a small group (7%) believe incorrectly that Antarctica has forests.

Eight out of ten adults and seven out of ten students chose the statement "most ice on Antarctica is always frozen but also slowly moving" as the best description of Antarctic ice, better than the statements "most Antarctic ice melts in the summer and freezes again in the winter" or "Antarctica is one enormous fixed and stable block of ice." Although the majority of respondents agreed to a correct definition of an ice shelf, most respondents are not knowledgeable about the formation and position of sea ice, ice sheets and ice shelves.

A majority of adults reveal that they are knowledgeable about Antarctica's climate in response to a series of six agree/disagree statements. More than half of the students agree that melting of Antarctica's ice will raise sea levels, that understanding past climate conditions can help us understand future climate, and that Antarctica affects climate beyond itself. Students are less knowledgeable about Antarctica's climate history and its current desert climate.

In response to a drawing of an Antarctic rock core, 84% chose correctly the oldest part of the core but not always for reasons reflecting geological knowledge. Half of adults and one-third of students gave an explanation for their choice that assumes action of layers of some sort being deposited over time and thus concluding that the deeper layers are older. Half of the adult sample and 7% of the student sample could identify all five components in an Antarctic rock core that tell scientists about the history of Antarctica's climate. Respondents consider that fossils of marine animals and plants and layers of sediment are most likely to tell scientists something about climate history.

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INTRODUCTION

As part of the International Polar Year activities, the *Engaging Antarctica* project will produce a NOVA PBS television show in addition to exhibits and activities for youth to increase public and student awareness and understanding about Antarctica. In collaboration with the *Engaging Antarctica* team, Multimedia Research developed a written online questionnaire to provide the project with a baseline understanding of adult and middle school students' knowledge of content associated with the project.

METHOD

Procedure

Adults and 7th grade students completed a 10-15 minute online survey assessing their knowledge about Antarctica (see Appendix).

Adult respondents were recruited through an e-mail sent to a NOVA's opt-in electronic mailing list. The e-list comprises 1400 viewers who are interested in receiving memos about science-related content. In previous studies using a general public NOVA e-list, we have obtained a 3% return rate. For this more specific NOVA e-list, our return rate is 7%. The following recruitment memo was mailed along with information about the upcoming week's NOVA (*Hitler's Sunken Secret*):

NOVA Antarctica Survey

Antarctica is a place of mystery and extremes. Scientific researchers working there face formidable challenges. Soon, NOVA will embark upon an adventurous expedition in Antarctica for the International Polar Year, a two-year international research effort by 26 nations that began in March 2007. To help us make the program informative and entertaining, we need your help. Please take 10 minutes of your time to participate in NOVA's online survey to help us understand what you know about Antarctica. Help NOVA bring you the exciting world of science! Click on the link below to connect to the 10-minute anonymous survey.

Student responses were obtained during classroom sessions of two 7th grade classes in a school in Natomas Unified Public School District in Sacramento, CA, and two 7th grade classes in a school in Loudoun County Public Schools in Leesburg, VA. Students in the CA school completed the survey online, whereas students in the VA school completed paper surveys because the network server was unavailable.

Data Analysis. Chi-square, Fisher's Exact tests and two-sample t-tests are used where appropriate for statistical analysis. All relationships are analyzed for statistical significance, which is reported in endnotes if p values are less than .05. Variables explored include age group and gender. Responses of agreement and disagreement with statements were given on a five point scale (strongly disagree, disagree, no opinion, agree, strongly agree). The two disagree and two agree

responses are collapsed into one category, yielding a three-point scale, for purposes of analysis and ease of presentation. Qualitative open-ended responses are sorted and analyzed by keyword and key phrase, and rounded-off percentages for adults and students are presented in tables.

Sample

Demographics

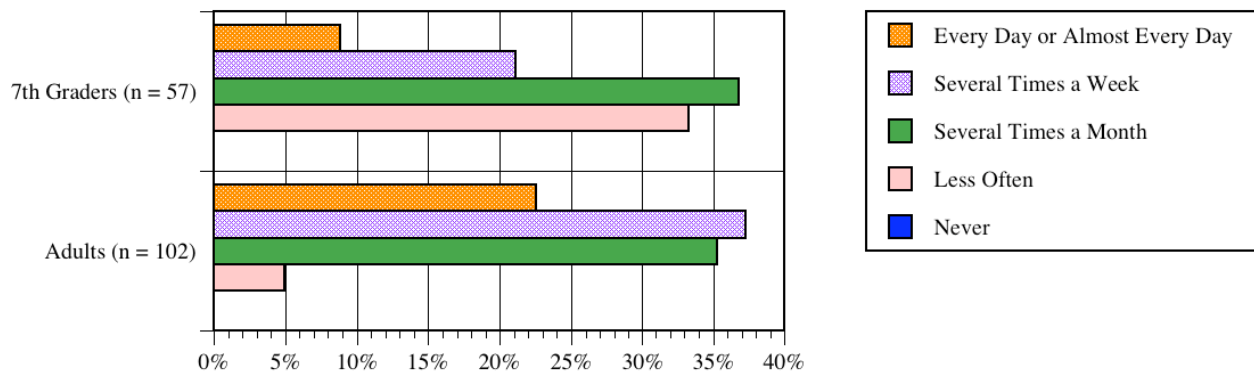
The adult sample includes a total of 102 respondents from 33 states plus Canada. Females comprise 39% of the adult sample, and the mean and median age is 53 years, ranging from 23 to 93 years. Ethnicity was not recorded.

The student sample includes a total of 92 7th graders, 46 from each school. Females comprise 51% of the student sample, and the mean student age is 12.6 years, ranging from 12 to 14 years. Ethnicity was not recorded, but 2000 Census Race and Ethnicity Data indicate that Natomas Unified Public School District has 29% “white alone population under 18” and Loudoun County Public Schools have 78% “white alone population under 18.”

Media Habits

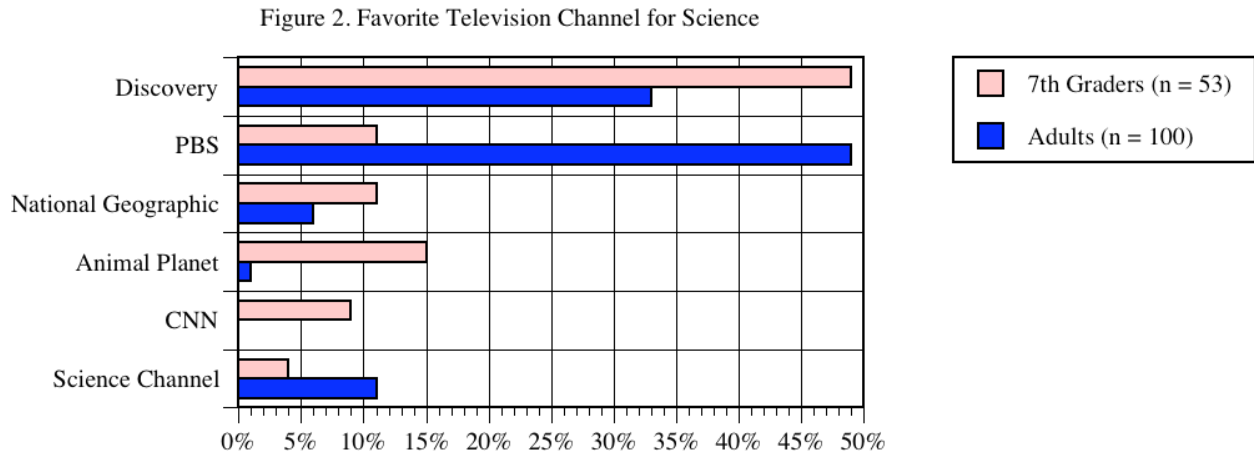
All of the adult respondents and 62% of students watch science programming on television. Adults watch significantly more frequently than students (see Figure 1 below).¹ Within the student sample, boys are significantly more likely to view science television than girls.²

Figure 1. Frequency of Viewing TV Science Programming on Any Network

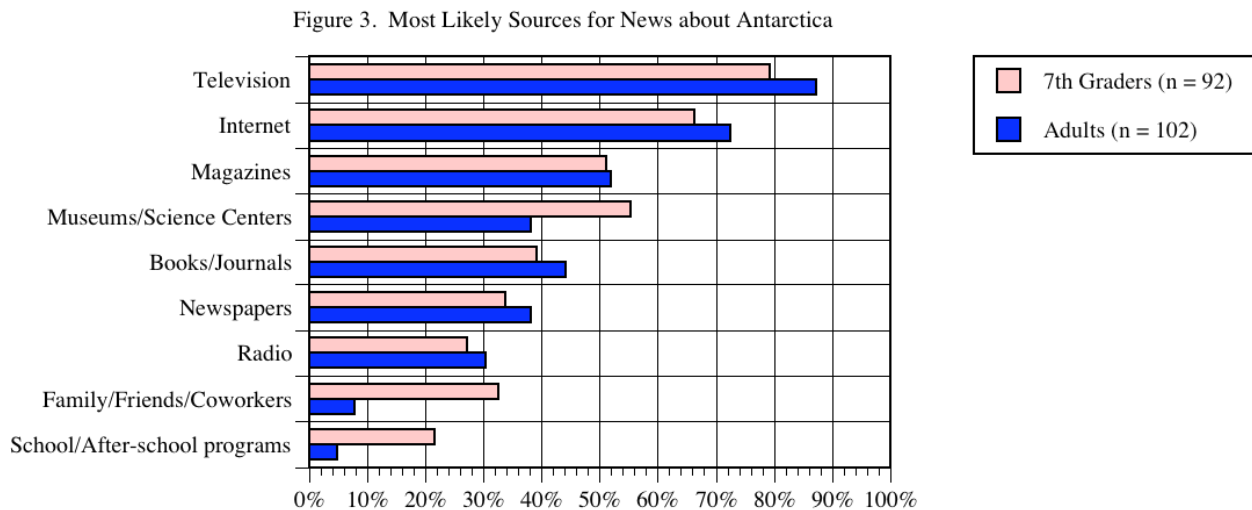


Of those who view science television programming, 100% of the adults and 37% of the 7th graders view NOVA. Half (54%) of the adult viewers and 7% of student viewers watch NOVA “regularly.” Adults watch NOVA significantly more frequently than students.³

The favorite television channels for science programming for adults are PBS (49%) and Discovery (33%). The favorite channels for 7th graders are Discovery (49%) and Animal Planet (15%). Figure 2 below presents the distribution of favorite science channels for the two samples.



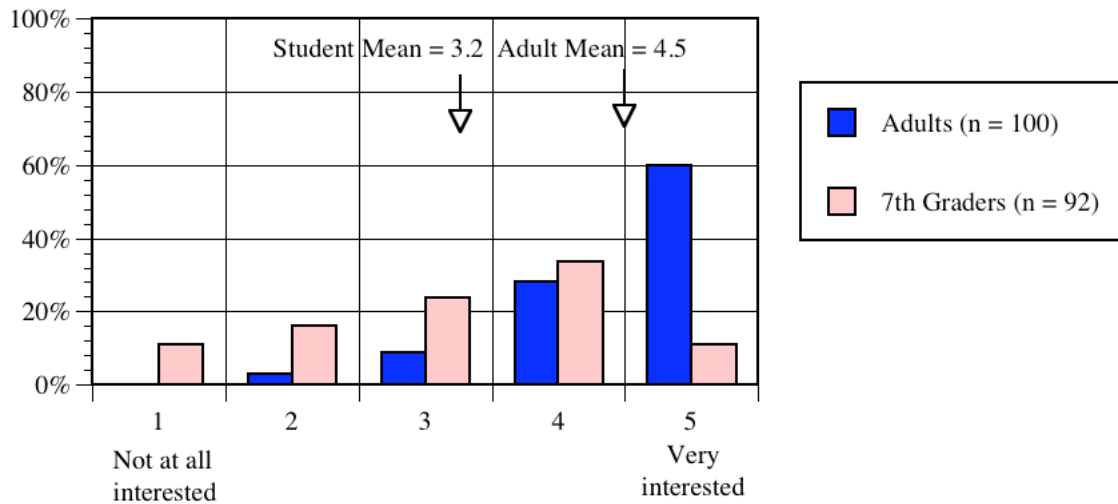
Respondents indicated through which of nine sources they were personally most likely to hear news about Antarctica. Figure 3 below presents the percentage of responses with highest percentage for the full sample at the chart's top and lowest at the bottom. The top categories for both adults and 7th graders are television (84%) and Internet (70%). Students are significantly more likely than adults to choose museums/science centers,⁴ family/friends/coworkers⁵ and school/after-school programs.⁶



Background

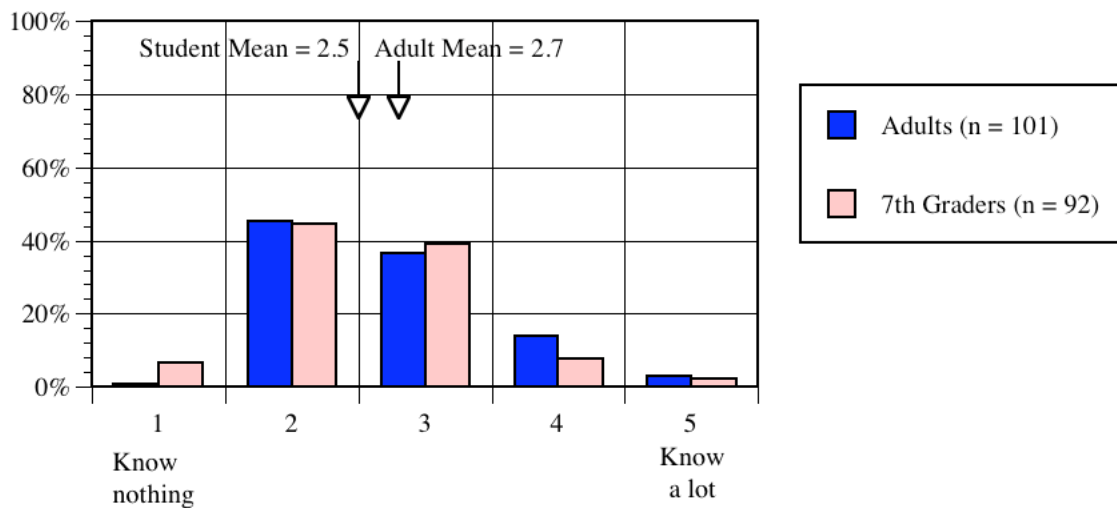
Adults are significantly more interested in learning about Antarctica than students.⁷ See Figure 4 below for distributions and means of interest ratings. Most of the adult respondents (88%) are “very” or “somewhat” interested in learning about Antarctica compared with 45% of 7th graders. Gender is not a significant variable in interest in learning about Antarctica.

Figure 4. Interest in Learning About Antarctica



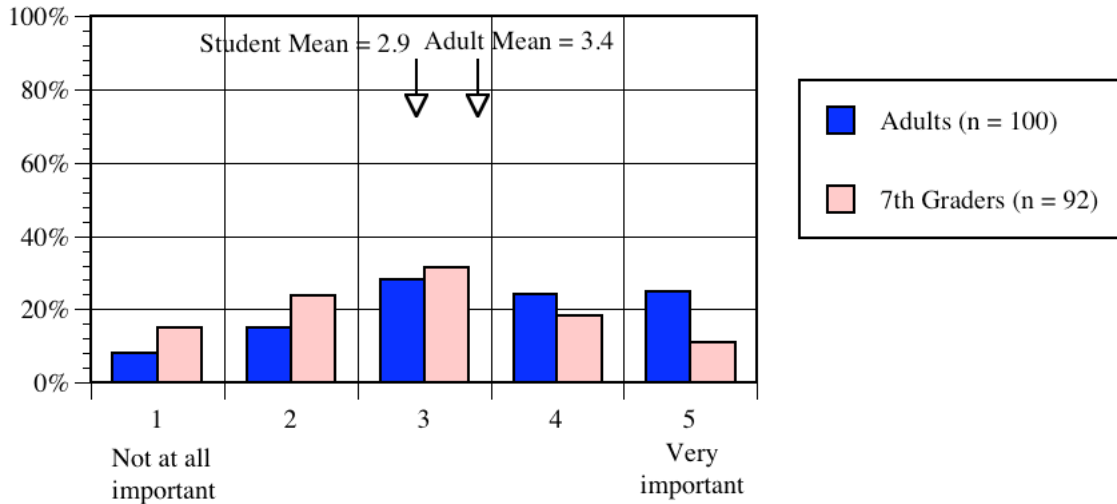
Although our NOVA-watching adults are more interested in Antarctica than the 7th grade sample, they do not feel more knowledgeable. See the Figure 5 below for distributions and means of knowledge ratings. The largest proportion of both samples (45%) report that they know “a little” (a 2 rating) about Antarctica. Gender is not significantly related to Antarctica knowledge ratings.

Figure 5. Knowledge About Antarctica



When asked to rate how important Antarctica is to their lives, 25% of adults give a “very important” rating compared with 11% of students. See Figure 6 below for distributions and means of importance ratings. On average, both adults and students feel relatively neutral about the importance of Antarctica to their lives, but adults rate importance significantly higher than students do.⁸ Gender is not significantly related to importance ratings.

Figure 6. Importance of Antarctica to One's Life



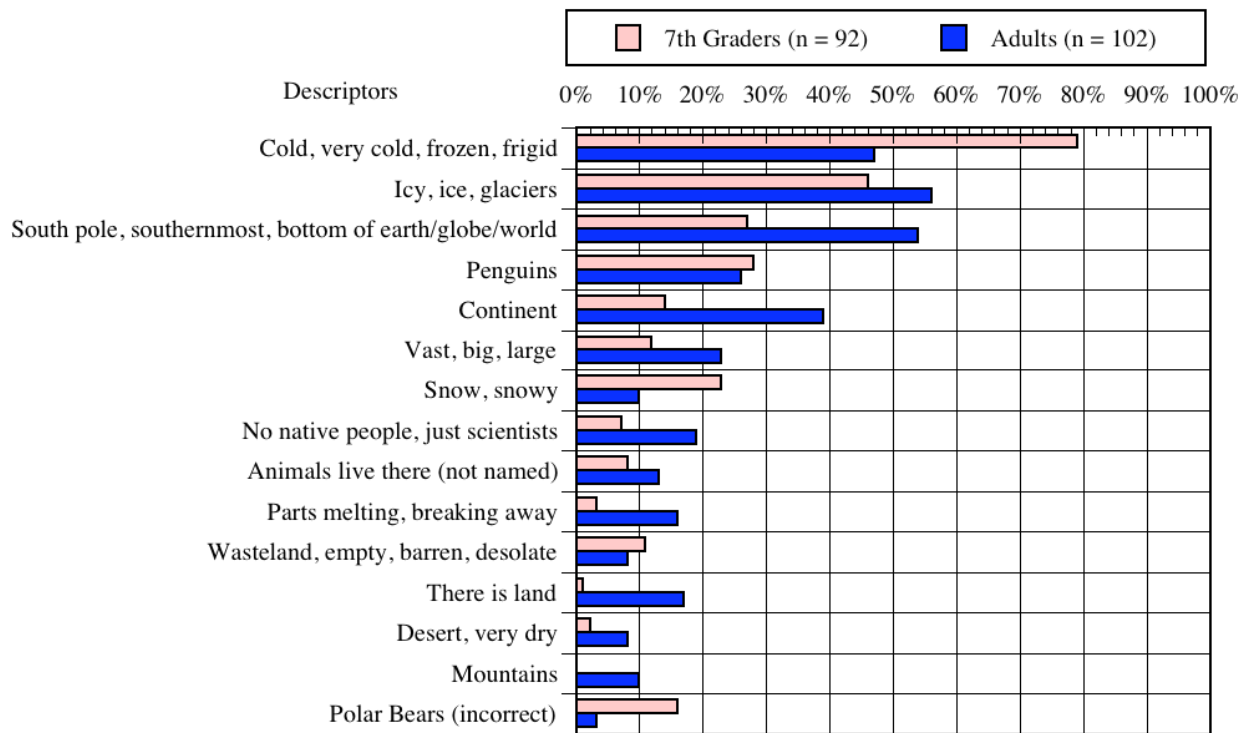
In summary, our adult sample is a science-attentive NOVA-viewing group, who is interested in the subject of Antarctica but does not feel well informed and is, on average, neutral about Antarctica’s importance in their lives. The public school 7th graders do not feel any better informed about Antarctica than the adults but are less interested in the subject and feel Antarctica is less important to their lives. Gender does not appear to influence either interest, knowledge or importance ratings. Both age groups expect to hear news about Antarctica most likely through television and the Internet.

KNOWLEDGE OF ANTARCTICA

Top-of-the-Mind Knowledge

To establish what is foremost in viewers' understanding about Antarctica, respondents were asked to describe Antarctica to someone who has never heard of the place. Figure 7 below presents descriptive categories offered by at least 5% of the total sample (10 respondents). Categories are presented with the highest percentage overall at the top and lowest percentage at the bottom. Both students and adults were most likely to note that Antarctica is very cold, icy, at the south pole, penguins live there, and it is a continent.

Figure 7. Description of Antarctica



Quotes from students to illustrate the range of answers:

- A very cold place, southern hemisphere, cold, bottom of the world, large, vast wasteland.
- It is like a wasteland full of ice and snow. It is very cold and storms can be vicious.
- It is a large, cold, uninhabited land mass at the southern end of the earth.
- Antarctica is a very cold place with lots of snow and penguins. It is south of all the other continents.
- It is a vast ice and snow covered place where huge glaciers live. Many penguins, seals and otters live there.
- A cold place in the south pole where penguins have adapted.
- A desert of ice and snow. Polar bears, south, bottom of the globe.
- Antarctica is a continent on the bottom of the earth. It is very cold and almost impossible to live in comfortably. There are very few animals that live there. Mostly only fish, some birds including penguins, polar bears, some walruses and leopard seals.
- A place that's very cold, has lots of snow and glaciers and has penguins, whales, and leopard seals living there.

Quotes from adults to illustrate the range of answers:

An icy continent located at the south pole.

A mostly ice covered continent at the bottom of our planet, commonly referred to as ‘the South Pole.’

A cold and frozen and inhospitable place. A place where mostly penguins live.

Coldest land populated with penguins for nesting. Shelf ice is melting.

A rocky, mountainous continent covered with snow and glaciers, located at the South Pole of the Earth. Very inhospitable to human life but inhabited by other animals and plants.

Antarctica is a vast, southern array of frozen tundra located at the south pole.

Antarctica is extremely cold, home of penguins, home of the south pole, covered by glaciers, with mountains in the center portion, and most of it is under water. Places in the interior are like deserts, where large cracks that might not be detected are the cause of deaths if anyone fell in them. The glaciers that bridge bay areas on the edges of Antarctica are melting.

A large, ice-covered continent covering the south pole of the Earth. I has buried lakes under a mile of ice and hosts species not seen anywhere on Earth.

A snow/ice covered continent at the south pole. Scientists from around the world study it. Climate change scientists are particularly interested in it due to its rich historical evidence buried in its ice sheets and because of the alarming increase in ice shelf destruction. The majority of ice is land-based. Some large sections of ice appear to be water-base but get major support from land, making them more significant to sea level rise if dislodged.

Descriptive facts

Respondents were asked a series of multiple choice questions to establish their knowledge of basic descriptive facts about Antarctica today. Almost all respondents know that Antarctica is south of their home and that penguins and glaciers exist there. Three-quarters of the sample know that seals and whales live in Antarctica, and two-thirds know that Antarctica has mountains and valleys. Bullets below give more details.

- ❖ 92% know that Antarctica is geographically located “south of” their home. Those few who chose “north of” their home were equally distributed by age group and gender, but those who answered “north” rated themselves as significantly less knowledgeable about Antarctica than those who answered “south.”⁹
- ❖ The majority of respondents are aware of the kind of animals that exist at Antarctica.
 - 95% know that penguins live there.
 - 76% know that seals live at Antarctica.
 - 75% know that whales live there, but adults are significantly more likely to give this answer than students (81% vs. 67%, respectively).¹⁰
 - 51% believe incorrectly that walrus live at Antarctica, but students are significantly more likely to give this answer than adults (64% vs. 39%, respectively).¹¹
 - 47% believe incorrectly that polar bears also live there, but students are significantly more likely to give this answer than adults (76% vs. 22%)¹² and females are significantly more likely to give this answer than males (56% vs. 41%).¹³ Those who chose “polar bears” also rated themselves as significantly less knowledgeable about Antarctica.¹⁴

- ❖ Respondents are less aware of the range of geological features that exist in Antarctica.
 - 97% know that glaciers exist in Antarctica.
 - 62% know that Antarctica has mountains and valleys, but adults are significantly more likely to give this answer than students (82% vs. 40%, respectively).¹⁵
 - 41% know that lakes appear in Antarctica.
 - 20% chose volcanoes as a feature of the continent, but adults are significantly more likely to give this answer than students (28% vs. 10%, respectively).¹⁶
 - 7% believe incorrectly that Antarctica has forests.

Knowledge of Antarctic Ice

Respondents were asked one multiple choice question and a series of agree/disagree statements to evaluate their knowledge about ice at Antarctica. Although three-quarters feel that the best descriptor of ice on Antarctica is “always frozen but also slowly moving,” a majority of respondents are not well-informed about the descriptions of sea ice, ice sheets and ice shelves. Adults are more knowledgeable than students in most cases.

Three-quarters (76%) of the sample chose the statement, “most ice on Antarctica is always frozen but also slowly moving” as the best description of Antarctic ice, given three possible statements. The statement, “most Antarctic ice melts in the summer and freezes again in the winter,” was chosen by 14% of respondents, and 10% chose “Antarctica is one enormous fixed and stable block of ice.” Adults were more likely than students to choose the best ice descriptor (82% vs. 69%).¹⁷

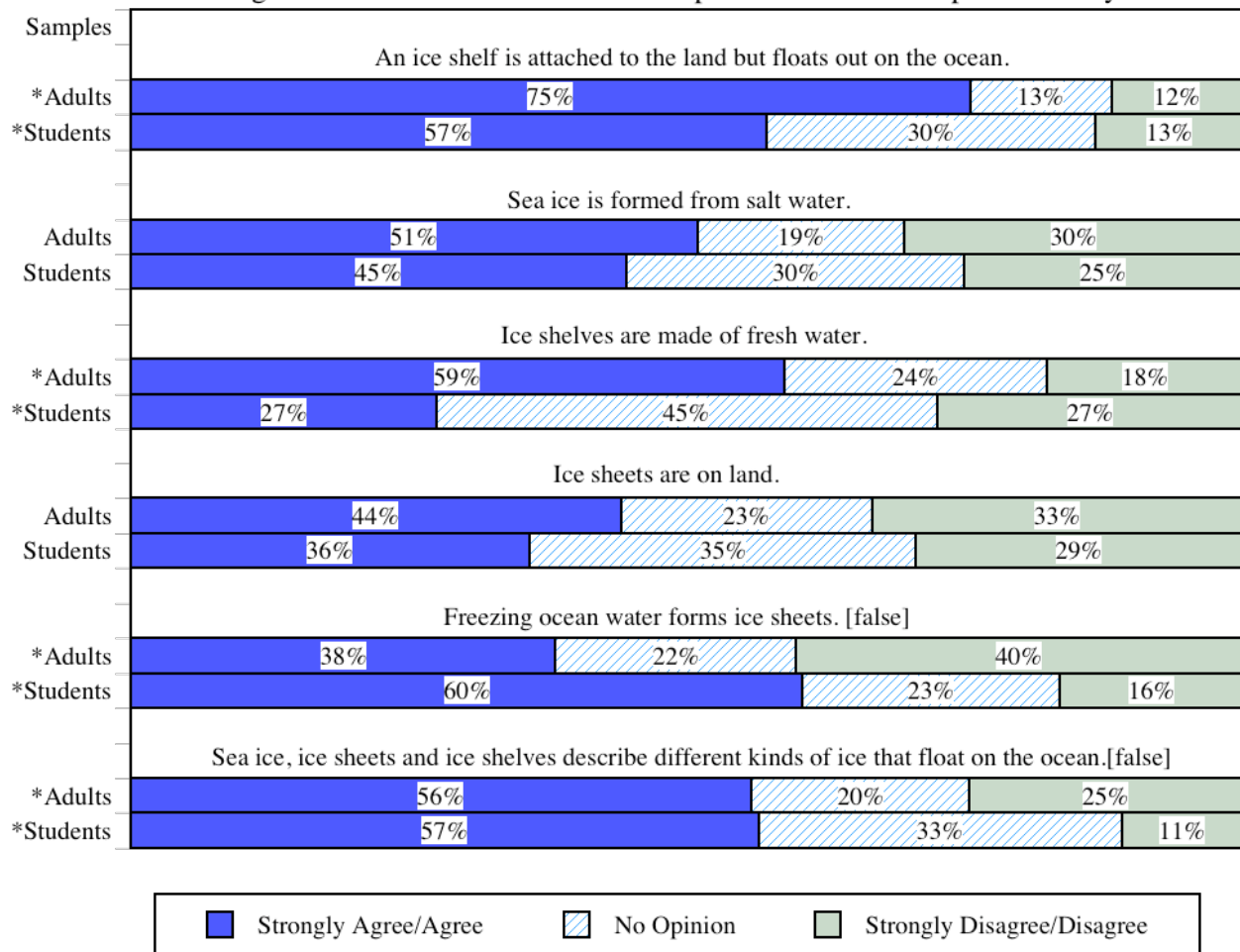
Respondents answered a series of agree/disagree statements to assess their knowledge about Antarctic ice. Table 1 presents the percentage of the full sample and sub-samples who gave “agree/strongly agree” or “disagree/strongly disagree” answers to six statements. Two-thirds of respondents agreed to the definition of an ice shelf but the majority are not knowledgeable about the formation and position of sea ice, ice sheets and ice shelves. Adults are significantly more knowledgeable than 7th graders; significant differences are indicated by percentages and endnotes in Table 1. One gender difference is also shown in Table 1.

Table 1. Percentage who “Agree/Strongly Agree” or “Disagree/Strongly Disagree” with Statements about Antarctica’s Ice

Statements	% All	Adults	Students	Males	Females
An ice shelf is attached to the land but floats out on the ocean.	67% agree	76%	57% ¹⁸		
Sea ice is formed from salt water.	48% agree				
Ice shelves are made of fresh water.	44% agree	59%	28% ¹⁹	67%	33% ²⁰
Ice sheets are on land.	40% agree				
Freezing ocean water forms ice sheets. [false]	29% disagree	40%	17% ²¹		
Sea ice, ice sheets and ice shelves describe different kinds of ice that float on the ocean. [false]	18% disagree	25%	11% ²²		

Figure 8 below also presents the percentage of agreement and disagreement by adults and students for each of the six statements described above. The statement bars are shown with the highest percentage correct at the top of the chart and lowest percentage at the bottom. Adults performed significantly better than students on four statements indicated by asterisks. Note that students tends to have a larger “no opinion” percentage than adults for each statement, indicating their uncertainty about the correct response.

Figure 8. Percent of Agree/Disagree Responses to Statements about Antarctic Ice
Significant Differences in Correct Response Between Groups Marked by *



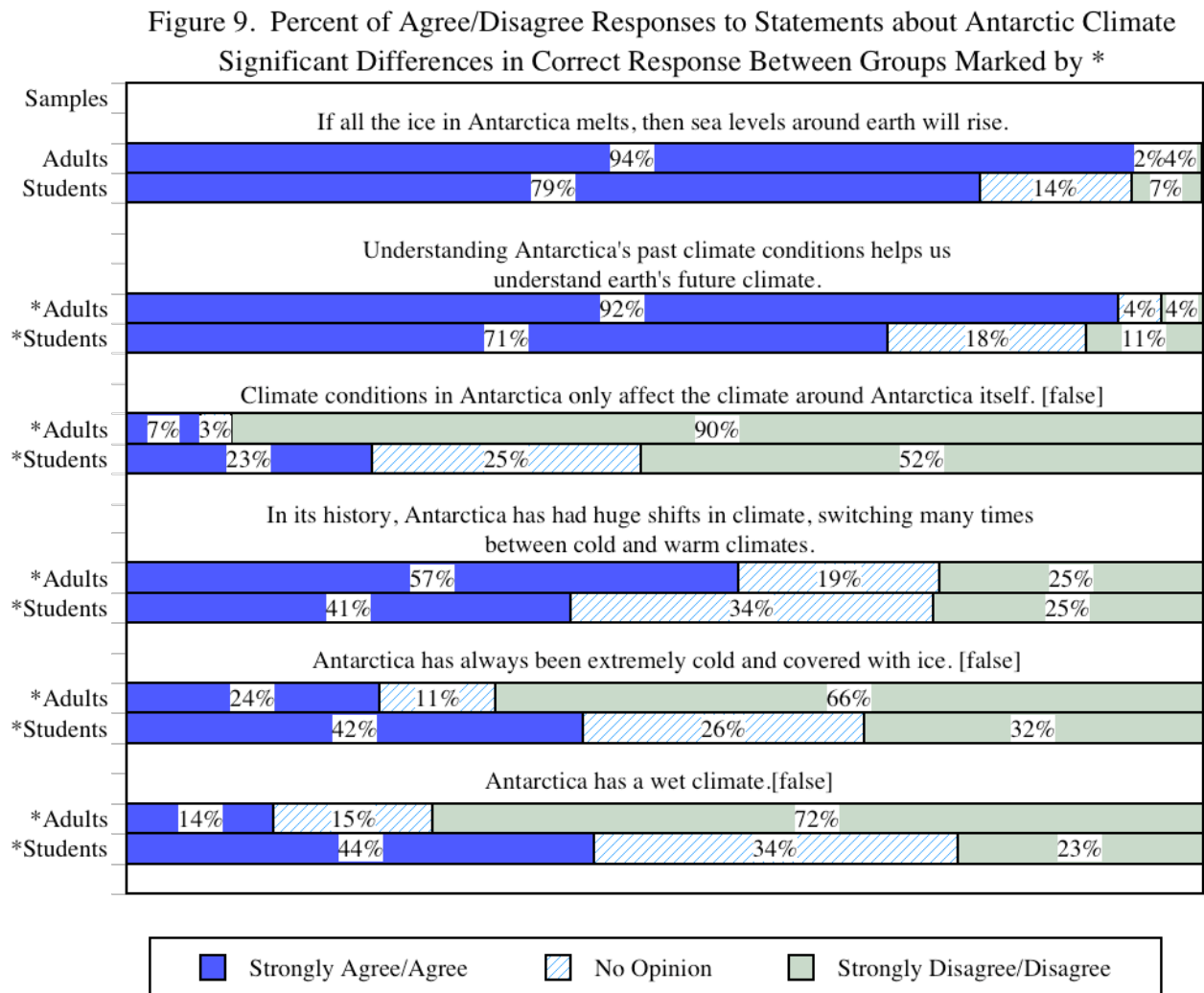
Knowledge of Antarctica’s Climate

Respondents answered a series of agree/disagree statements to assess their knowledge about climate related to Antarctica. Table 2 presents the percentage of the full sample and sub-samples who gave “agree/strongly agree” or “disagree/strongly disagree” answers to six statements. A majority of adults are knowledgeable about Antarctica’s climate. Adults are also significantly more knowledgeable than 7th graders; significant differences are indicated by percentages and endnotes in Table 2. More than half of the students are aware that melting of Antarctica’s ice will raise sea levels, that understanding past climate conditions can help us understand future climate, and that Antarctica affects climate beyond itself. Students are less knowledgeable about Antarctica’s past climate and its current desert climate. Two gender differences are also shown in Table 2.

Table 2. Percentage who “Agree/Strongly Agree” or “Disagree/Strongly Disagree” with Statements about Antarctica’s Climate

Statements	% All	Adults	Students	Males	Females
If all the ice in Antarctica melts, then sea levels around earth will rise.	87% agree	94%	79% ²³		
Understanding Antarctica’s past climate conditions helps us understand earth’s future climate.	82% agree	92%	71% ²⁴		
Climate conditions in Antarctica only affect the climate around Antarctica itself.	72% disagree	90%	52% ²⁵		
In its history, Antarctica has had huge shifts in climate, switching many times between cold and warm climates.	49% agree	57%	41% ²⁶		
Antarctica has always been extremely cold and covered with ice.	49% disagree	66%	32% ²⁷	56%	41% ²⁸
Antarctica has a wet climate.	48% disagree	72%	23% ²⁹	58%	36% ³⁰

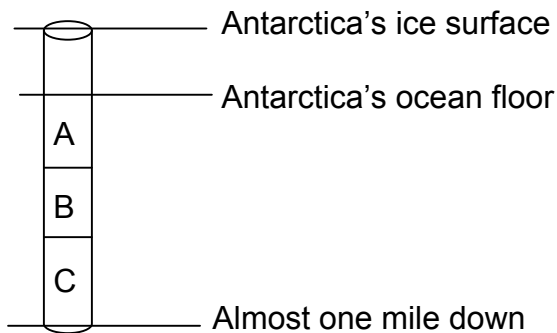
Figure 9 below also presents the percentage of agreement and disagreement by adults and students for each of the six statements described above. The statement bars are shown with the highest percentage correct at the top of the chart and lowest percentage at the bottom. Adults performed significantly better than students on five of the six statements, indicated by asterisks. Note that students tends to have a larger “no opinion” percentage than adults for each statement, indicating their uncertainty about the correct response.



Understanding Rock Cores

Two questions addressed respondents' understanding of rock cores. The first question appears below and assesses the concept that deeper is older in sedimentary rocks:

Imagine that scientists use a large drill rig to core into sediments beneath the ocean around Antarctica. Here is a drawing of the core.

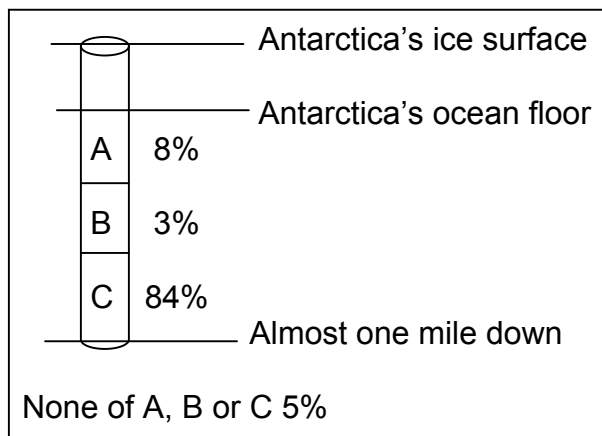


Looking at the drawing, which do you think is the oldest part of the core?

- A
- B
- C
- None of A, B or C

Please explain why you chose the answer you did for the previous question:

A large majority of the sample (84%) chose C as the oldest part of the core, as shown in the drawing below. Students and adults agreed upon this answer.



Those who chose A (8%) gave a wide variety of explanations, indicating either a misunderstanding of Antarctic geology or the core drilling process or a misinterpretation of the question and drawing:

I would imagine that most continents were formed by volcanic activity and plate movement. If this were true then A,B,and C are part of the plate. Magma would be constantly coming up from below and pushing up against the plate and cooling to form new land. This stuff would be younger and push the older stuff higher. I am only guessing the floor of the ocean is changing the least rapidly. Some change seems more likely some distance beneath the ocean floor.

If you go further or higher into the earth it will get warmer from the sun or from lava.

Because there has been ice in Antarctica longer than there has been land.

I chose A because the first one is always the oldest.

The ice moves.

The ice first formed at the top and then went down.

A is on top so water can't be there so it freezes.

Because it can't freeze up, the ocean water underneath is freezing.

The core rises up from the bottom.

The drawing shows [that] A is reaching to one mile down due to the pole being turned over before being thrust into the earth. Thus, A is the oldest for having been the last to reach the deepest and oldest of the ocean's floor.

I chose this answer because the letter A had a bigger space on the drill.

The few who chose B (3%) either guessed or gave explanations reflecting misunderstandings of the geology of Antarctica or of the drill core.

I guessed.

I have no idea, it's a guess.

The B section of the core would be stable while the other sections may change with currents above and below the surface.

I think that B is the oldest part of the core because the core spreads about and gets larger. It spreads out not in. Ice would constantly extend the continent and scrape off the surface of the broken land mass eroded and fissured by expanding and contracting ice. The random rock piles as moraines would tumble into the ocean and fall from released melting ice burs over the duration of many iceages. As the ice shelf gained weight and mass the core would compress and reform the sediment found beneath while trickled and percolated sediment would also create new rock near that lower depth and crust pressure with seismic activity continental drift.

The few who chose “None” (5%) gave a variety of explanations or made this choice as a “don’t know” alternative:

I think the bottom of the ice is older than the sediment almost one mile down.

Because of where Antartica is located on earth it is on the underside, therefore I think the top layer would be the oldest.??

Because of underwater volcanoes

Ice cores can be bigger.

Because they use every part and build every part at almost the same time so none of them are older than the next.

Religious purposes

Don’t know?

It is confusing.

I think that its a tricky question and so I chose none.

The majority (84%) of the sample chose C as the oldest part of the core, but explanations for this answer reflect different, and not always correct, interpretations for why C is the oldest.

- ❖ Half (52%) of adults and 35% of students provide an explanation that assumes action of layers of some sort being deposited over time and thus concluding that the deeper layers are older.
 - The most complete answer category notes that ‘sediments layer over time so deeper layers are older’: 27% of adults provide an answer in this category but only 7% of students.
 - Another group of respondents assume that the A, B, C section is not sedimentary rock but that ‘snow or ice layer over time so deeper layers are older.’ (15% adults; 12% students)
 - A smaller portion of the sample describe a layering in which ‘deeper or bottom layers are older’ but do not specify what is being layered. (8% adults; 11% students)
 - An even smaller group focuses on the action of time that ‘C is formed first.’ (2% adults; 5% students)
- ❖ One-quarter (19%) of adults and 30% of students simply declare that ‘older is deeper or at the bottom’ without further explanation.
- ❖ 4% of respondents choose C because it is ‘less likely to thaw.’
- ❖ 3% choose C because it is ‘so deep that change cannot take place.’
- ❖ 10% provide non-scientific or irrelevant explanations
- ❖ 15% gave no explanation or say they guessed.

Table 3 presents categories of explanations, illustrative quotes for each category, and percentages of the adult and student sample falling into those categories.

Table 3. Explanations for Choice of C as Oldest Part of Core

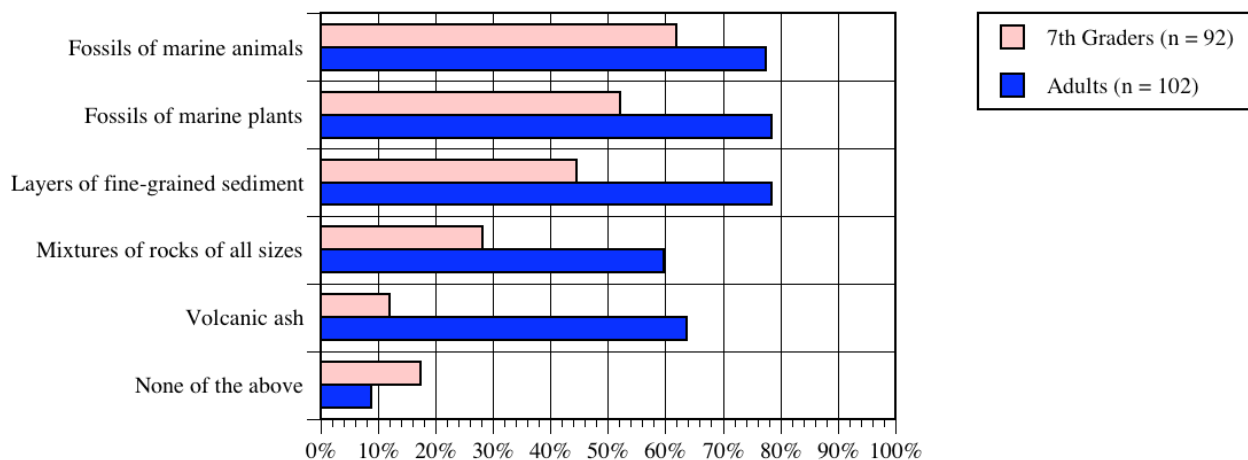
Explanation Category Illustrative Quotes A= Adult; S = Student	87% Adult N=102	81% Student N = 92
<p>Sediments layer over time so deeper layers are older. A: Sediments are formed as material is added on top, therefore the oldest material is the deepest. A: Sedimentary layers are built up by material falling from the surface and covering what is already there. So year after year the layers grow upward with the oldest at the bottom and the newest at the top. A: The higher levels would be more recent due to sediment or volcanic activity adding new material onto the previous. A: Principle of Superposition – part C is below the others, so it must have been deposited before A and B, therefore it is older. S: Because the sediment on the bottom is older than new sediment made on the top. S: Because new soil or whatever goes over the top of old soil.</p>	27%	7%
<p>Snow or ice layer over time so deeper layers are older. A: Because the snow that fell hundreds of thousands of years ago has been crushed by the weight of the snow above it making it into ice. The snow and ice build up every year and so you get the layering effect, A younger than B, B younger than C. A: Ice is usually formed by precipitation which accumulates and compresses. The oldest formed ice from this accumulation would be on the bottom. A: Like rock strata, as ice forms, the newer deposit is on top of the older deposit. S: I chose C because the bottom part of the ice moves down and the new ice goes to the top and pushes the other old one down. S: The farther down ice is, the older it is. In National Geographic Magazine it said that ice in Antarctica can be as old as 100 million years. S: The oldest ice is on the bottom and the new ice layers on top of that ice.</p>	15%	12%
<p>Deeper or bottom layers are older. A: The oldest section has been pushed down by newer layers. A: The deeper the older, except where plate tectonics and earthquakes have rearranged the layers. A: The oldest layers are on the bottom. S: It is at the bottom and things start at the bottom and pile on top, so C is the oldest. S: Because it is layered and C is the bottom of all the layers making it the oldest part of the core. S: Because the deeper down you go, the older it gets and new formations go on top of it.</p>	8%	11%
<p>C is formed first. A: Because it is the first formed. A: Old things use to go first from bottom up. S: You cannot build top to bottom so the bottom must come first. S: Because everything starts at the bottom.</p>	2%	5%
<p>Older is deeper or at the bottom. A: The oldest should be at the bottom. A: I would think the deeper the core sample is taken, the further back in time (geologically) you are looking. A: The lower the earth, the older it is. S: It seems to be lowest on the chart which means it's been there longer. S: I chose this because in the science documentaries I have seen and in them whenever they do drilling they say the deepest part is always the oldest. S: Because the deeper you go down, the older it gets.</p>	19%	30%

C is less likely to thaw. A: A and B might be subject to melting and refreezing. A: It would seem to me that anything beneath the ocean floor would have to be older than something close to the surface because of thawing and freezing nearer the surface. S: The oldest would be the bottom because the sun can't reach. S: I think that C is the answer because everything at the top makes it even colder at the bottom.	2%	2%
C is so deep that change cannot take place. A: Not much chance for change that deep into the earth. A: I'm assuming there would be little movement or change that far down. S: Because it's the farthest down and can't be tampered with.	2%	1%
Non-scientific explanations? A: Antarctica is a continent and the ice rests on that surface. A: The mountains in Antarctica are high and I believe there are (soil) valleys that are one mile or so before the ice's surface. Antarctica is so large that it is deemed a continent. A: You also drill into the core of the earth. S: Because it looks old. S: Because the bottom parts are mostly rusty.	7%	3%
No answer or guessed	6%	9%

A second question about the science of rock cores asked respondents to choose which of five components in an Antarctic rock core tell scientists about the history of Antarctica's climate: fossils of marine animals; fossils of marine plants; layers of fine-grained sediment; mixtures of rocks of all sizes; volcanic ash. All five components tell scientists something about climate history.

Half (49%) of the adult sample checked off all five components; whereas only 7% of students did. On average, adults selected significantly more choices than students (adult mean = 3.6; student mean = 2).³¹ Figure 10 below presents percentages of each sample choosing a component, with most preferred choices at the top of the chart. Fossils and sediment were considered most likely to help scientists learn about Antarctica's climate history.

Figure 10. Components of an Antarctic Rock Core that tell Scientists about Climate History



APPENDIX

Web-based Survey for Engaging Antarctica: Front End Evaluation

(Note: Order of response categories was randomized wherever logical, and respondents could not return to a previous question once answered.)

1. How important is Antarctica to your life?

Not at all important

1

2

3

4

Very important

5

2. How much do you feel you know about Antarctica?

Know nothing

1

2

3

4

Know a lot

5

3. How interested are you in learning about Antarctica?

Not at all interested

1

2

3

4

Very interested

5

4. Where is Antarctica in relation to where you live?

- East of my home
- West of my home
- South of my home
- North of my home

5. How you would describe Antarctica to someone who has never heard of the place:

6. In your view, which one of the statements BEST describes the ice of Antarctica today?

- Antarctica is one enormous fixed and stable block of ice.
- Most Antarctic ice melts in the summer and freezes again in the winter.
- Most ice on Antarctica is always frozen but also slowly moving.

7. Through what sources are you personally MOST likely to hear news about Antarctica? (Check all that apply)

- Newspapers
- Magazines
- Internet
- Television
- Radio
- Family, Friends, Coworkers
- School/After-school programs
- Books/Journals
- Museums/Science Centers

You have completed 1/4 of the survey.

8. Which of the following can be found in Antarctica? (Check all that apply)

- Forests
- Glaciers
- Lakes
- Mountains and valleys
- Volcanoes

9. What animals can we find today on land and in the water at Antarctica? (Check all that apply)

- Polar Bears
- Penguins
- Seals
- Whales
- Walruses

10. Rate how much you DISAGREE or AGREE with each of the statements below.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Sea ice, ice sheets and ice shelves describe different kinds of ice that float on the ocean.					
Sea ice is formed from salt water.					
Ice sheets are on land.					
Freezing ocean water forms ice sheets.					
An ice shelf is attached to the land but floats out on the ocean.					
Ice shelves are made of fresh water.					

11. Do you watch science programming on television?

- Yes
- No – survey skips over next 3 TV questions

You have completed 1/2 of the survey.

12. How often do you watch TV science programming on any network?

- Every day or almost every day
- Several times a week
- Several times a month
- Less often
- Never

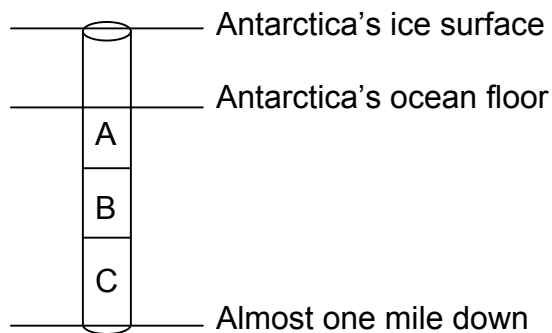
13. If you watch science on television, which channel is your favorite? Choose one.

- PBS
- Discovery
- National Geographic
- CNN
- Animal Planet
- Science Channel
- Other: ____

14. How often do you watch the NOVA weekly television series on PBS?

- Regularly
- Sometimes
- Never

Imagine that scientists use a large drill rig to core into sediments beneath the ocean around Antarctica. Here is a drawing of the core.



15. Looking at the drawing, which do you think is the oldest part of the core?

- A
- B
- C
- None of A, B or C

16. Please explain why you chose the answer you did for the previous question (#14):

You have completed 3/4 of the survey. Just a few more questions.

17. Looking in an Antarctic rock core, which of the following tell scientists about the history of Antarctica's climate? (Check all that apply)

- Fossils of marine animals
- Fossils of marine plants
- Mixtures of rocks of all sizes
- Layers of fine-grained sediment
- Volcanic ash
- None of the above

18. Rate how much you DISAGREE or AGREE with each of the statements below.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Antarctica has a wet climate.					
Understanding Antarctica's past climate conditions helps us understand earth's future climate.					
If all the ice in Antarctica melts, then sea levels around earth will rise.					
Climate conditions in Antarctica only affect the climate around Antarctica itself.					
In its history, Antarctica has had huge shifts in climate, switching many times between cold and warm climates.					
Antarctica has always been extremely cold and covered with ice.					

To ensure that we have a representative sample of respondents, we would like some anonymous background information:

19. What state do you live in?

20. What is your gender?

- Female
- Male

21. What is your age?

Thank you for your responses. Please click on SUBMIT to complete this survey. After submission, you will end up on the Antarctica Drilling website, andrill.org, where you can learn more about current research on Antarctica.

ENDNOTES: STATISTICAL TESTS

- ¹ A 2 x 4 chi-square test indicates the relationship between age group and viewing frequency is significant, $\chi^2(3, N = 194) = 26.60, p \leq .0001$.
- ² A 2 x 2 Fisher Exact test ($p = .033$) reveals the relationship for students between gender and viewing is significant.
- ³ A 2 x 3 chi-square test indicates the relationship between age group and NOVA viewing frequency is significant, $\chi^2(2, N = 159) = 88.50, p \leq .0001$.
- ⁴ A 2 x 2 Fisher Exact test ($p = .021$) reveals the relationship between age group and museum/science center choice is significant.
- ⁵ A 2 x 2 Fisher Exact test ($p = .0001$) reveals the relationship between age group and family/friends/coworkers choice is significant.
- ⁶ A 2 x 2 Fisher Exact test ($p = .0005$) reveals the relationship between age group and school/after-school programs choice is significant.
- ⁷ A 2 x 5 chi-square test indicates the relationship between age group and interest in learning about Antarctica is significant, $\chi^2(4, N = 192) = 61.90, p \leq .0001$.
- ⁸ A 2 x 5 chi-square test indicates the relationship between age group and importance of Antarctica is significant, $\chi^2(4, N = 192) = 10.29, p \leq .0359$.
- ⁹ Mean knowledge rating of “south” responders = 2.7; Mean rating of “north” responders = 2.1; $t(18) = 3.765, p = .0013$.
- ¹⁰ A 2 x 2 Fisher Exact test ($p = .03$) reveals the relationship between age group and “whales” choice is significant.
- ¹¹ A 2 x 2 Fisher Exact test ($p = .0006$) reveals the relationship between age group and “walruses” choice is significant.
- ¹² A 2 x 2 Fisher Exact test ($p = .0001$) reveals the relationship between age group and “polar bear” choice is significant.
- ¹³ A 2 x 2 Fisher Exact test ($p = .04$) reveals the relationship between gender and “polar bear” choice is significant.
- ¹⁴ Mean knowledge rating of choosers of “polar bears” = 2.5; Mean rating of non choosers = 2.8; $t(190) = 2.601, p = .01$.
- ¹⁵ A 2 x 2 Fisher Exact test ($p = .0001$) reveals the relationship between age group and “mountains and valleys” choice is significant.
- ¹⁶ A 2 x 2 Fisher Exact test ($p = .0011$) reveals the relationship between age group and “volcanoes” choice is significant.
- ¹⁷ A 2 x 2 Fisher Exact test ($p = .042$) reveals the relationship between age group and “best statement” choice is significant.
- ¹⁸ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 193) = 9.15, p = .0103$.
- ¹⁹ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 193) = 19.43, p \leq .0001$.
- ²⁰ A 2 x 3 chi-square test indicates the relationship between gender and agree-disagree statement is significant, $\chi^2(2, N = 192) = 8.613, p = .0135$.
- ²¹ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 193) = 14.24, p = .0008$.
- ²² A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 8.164, p = .0169$.
- ²³ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 11.11, p = .0039$.
- ²⁴ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 15.43, p = .0004$.
- ²⁵ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 35.79, p \leq .0001$.
- ²⁶ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 6.632, p = .0363$.
- ²⁷ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, $\chi^2(2, N = 194) = 22.99, p \leq .0001$.

²⁸ A 2 x 3 chi-square test indicates the relationship between gender and agree-disagree statement is significant, χ^2 (2, N = 193) = 7.089, $p = .0289$.

²⁹ A 2 x 3 chi-square test indicates the relationship between age group and agree-disagree statement is significant, χ^2 (2, N = 194) = 46.46, $p \leq .0001$.

³⁰ A 2 x 3 chi-square test indicates the relationship between gender and agree-disagree statement is significant, χ^2 (2, N = 193) = 9.237, $p = .0099$.

³¹ t (191) = 6.822, $p \leq .0001$.