**GRADE LEVEL:** 11 - 12

**MATERIALS:** Internet access, computer

**OBJECTIVE: Critically** interpret public opinion of climate change, provide an accurate analysis for review by researchers.

**SKILLS:** Develop data analysis skills, critically evaluate opinion vs. fact

**VOCABULARY:** (global) climate change, global warming

**OVERVIEW (for students):** Television (particularly cable television!) and the internet have brought news media into every home in a much more vivid and descriptive way than in previous history. People now have access to information from around the globe at any time of day, as it happens. People react to the news, and formulate opinions based on their life experiences, moral beliefs, and information available to them. The advent of social media has provided the general populace with the opportunity to voice those opinions in a much more public way than ever before.

One of the most prodigious social media outlets is Twitter. It provides an author the opportunity to state a feeling, “fact”, or other piece of information in 140 characters or less. The tweets can be viewed and shared among followers. This platform allows for opinions on “hot button topics”, or news items that cause a strong emotional response from people, to be shared from around the world.

Global climate change, or global warming, is a “hot button topic”. By analyzing tweets about climate change, we can collect data and develop information about how the public generally feels about climate change.

The UND Computational Research Center is working on collecting tweet data using Citizen Science Grid public volunteers to help classify more than one million tweets. Through the Supercomputing Challenge, you are able to be part of this unique project by helping to classify tweets and provide your personal interpretation of your results.

**(for teachers):** Document the process during this lesson through photos, short video clips, and collecting the “drafts” of data analysis along the way. This will be important to review with the students prior to their documentation phase.

**PART I: Data Collection**

**INTRODUCTION (for students):** Research is based on the collection of facts, or data, that are used to support various conclusions drawn by the researcher. This part of the project takes the qualitative tweets and transforms them into a quantitative data set that can be reviewed and analyzed. You will be classifying tweets according to attitude, evidence, emotion, impacts, or other qualities.

**DIRECTIONS (for teachers):** Prior to beginning tweet classification, discuss with the students what they feel the public opinion is for climate change. Students will use the classification details below to establish their own individual result expectations, as well as a class consensus for the data they will collect. Students should take notes and record their individual and the class expectations for reference later.

Sign in and access the “Climate Tweets” website according to the instruction page provided with this lesson plan. Discuss the “Instructions” link at the top of the “Climate Tweets” website so students are able to refer to it if they are unsure how to classify a tweet. Have each student read at least 50 tweets, marking the appropriate radio button and check boxes. For each tweet classification to be valid, students must select an attitude, and can select only up to **3** category check boxes.

**(for students)**

1. **Attitudes:** Did the author of the tweet believe that climate change is a major issue or “much ado about nothing”?

*There are 5 levels of attitude for climate change ranging from -2 (Strongly Denies Climate Change) to +2 (Strongly Acknowledges Climate Change). Some people see climate change as a major problem. Even small changes in global temperatures will have cataclysmic and irreversible consequences (strongly acknowledges climate change). Others believe that the Earth’s climate naturally goes through cycles of warming and cooling. This process has been going on for ages, and this is just another one of those cycles (strongly denies climate change). Maybe, although climate change is important, the author may feel that there are bigger problems to worry about, such as race or class struggles, than if the temperature of the oceans is going to be an average of 2 degrees warmer in 10 years (neutral/inconclusive or unknown). Use your best judgment for the scale provided to determine how strongly the author feels about climate change.*

1. **Evidence and Emotion:** Did the author of this tweet indicate the focus on climate change is an evidence issue or an emotional one?

*These two categories have 5 possible check boxes: Evidence – Drivers of Climate Change, Science of Climate Change, Denial of Climate Change; and Emotion – Politics, or Ethics and Moral Responsibility. Did the author use facts such as greenhouse gas levels (driver), coal burning (driver), CO2 graphs (science), or climate change models (science) to prove their point? Or maybe, the author claimed that global climate change is a political or ethical issue: a trick to win votes or get funding for a special interest group (political issue), or question what policy makers are doing to save the environment for future generations (moral issue)? Maybe the author combined some of these, such as, “Big oil owns senators (political). The Earth has already been hotter! (scientific) #TimeoftheDinosaurs #MediaPropaganda” (denial).*

1. **Impacts:** Did the author indicate that climate change will result in extreme events, unusual weather, threats to the environment, or threats to society and the economy?

*This question really gets at what the author either saw as evidence, or feared will happen. They might have referred to studies of polar bear habitat shrinking due to melting of polar ice (environment), or claimed melting polar ice will cause X ft of ocean level rise that will threaten island nations such as Fiji, Haiti, or even Japan (society). They feared increases in average sea surface temperatures will lead to increased frequency (weather) and severity (extreme) in storm events such as hurricanes or tornadoes. “Mexico had its first Cat5 hurricane!” (extreme) “They can’t afford to lose tourists to huge storms!” (society) #SpringBreakWhere?*

1. **Other:** Did the author truly tweet about climate change or was their tweet about something completely different?

*Maybe the author of the tweet didn’t understand the topic, or maybe they were just trying to be funny. “What is the climate changing into?” (unknown). “At least if we warm up a bit, we’ll have better tanning weather!” (joke) Regardless of what the author tried to convey, these tweets likely don’t include any references to the options in the other categories.*

**PART II: Data Analysis**

**INTRODUCTION (for students):** Data is only the first step in developing understanding. A researcher needs to consider their data and decide what, if any, patterns can be shown by the data. Some information may be obvious, like kids drink less coffee than adults. Other information may be inferred by combining pieces of data. For example, maybe we knew that professional adults consume more coffee than college students, but college students spend more money on coffee than professionals. Then, we can infer that professionals likely have access to a free source of coffee, such as the coffee pot at work, which the college students do not have.

When you finished classifying your tweets, your data was used to create an individual bar graph of the categories you assigned and pie chart of the tweet attitudes. Your data was compiled with the rest of the class to show how your class classified tweet categories and attitudes as a group. Using your individual and class results, you will evaluate your classification methods, and your classification results in small groups.

**DIRECTIONS (for teachers):** Break the students into groups of 4 to 5 students to discuss the tweets they read. Students should determine what patterns they see and what data can be combined to infer other patterns. Each small student group should create a clear description of the information they inferred from their data sets. The students can use the questions below to guide their discussion. One student will record the major points of the discussion for each group.

1. How well did your tweet classification results match the expectations you discussed prior to classifying the tweets? What factors do you feel influenced your results to either match or deviate from those expectations?
2. Is there a “magic number” of tweets about where the percentages in the pie chart, or relative sizes of the bars in the bar graph wouldn’t seem to change much for your classification data and/or the class cumulative data?
3. Do you feel that the tweet classification process was able to deliver generalized fair and accurate quantitative results that captured your overall impression of the tweets? What aspects of the process aided or hindered a close result relationship between your personal human impression and the quantified data?
4. In what ways do the aggregated tweet classification results create opportunities for missing important tweet detail trends or misinterpreting the tweet authors? What data results or classification requirements would you include to help capture these? How would the added data result directly contribute to a more accurate interpretation public opinion represented by the tweets?
5. Beyond what has been discussed above, what additional sources for error can you find for this project? (Make sure to consider the process, data source, results, interpretation, etc.) What would you do to minimize these errors?

After the small groups have decided on the information shown by their results, one or two representatives from each small group will present their results to the each of the other groups in a “round robin” review. During the review, students will provide each other feedback, both positive and critical, for the representative to take back and review with his/her group. The review feedback should be used by each group to amend their conclusions accordingly.

**PART III: Information Distribution**

**INTRODUCTION (for students):** The ultimate goal of a researcher is to disseminate the information they obtained from the research they conducted. The final product is a journal article that has peer review and is published for other researchers interested in similar topics to refer to and cite when conducting their research. Journal articles have a specific format. You will write up your research similar to a journal article.

**DIRECTIONS (for teachers):** Students will complete this portion of the project individually. Review with students the documentation you have been collecting (i.e., photos, video clips, etc.) to refresh their memories prior to the writing process. Students will write a report to include the following sections: Introduction, Methods, Data, Results, and Conclusions. You have the option to ask the students to write up an Abstract as well. The Introduction should include a quick statement about what the research was about, and why they felt it was important. The Methods should describe how they extracted their data, and the discussion/analysis process. Students should be specific and provide at least 3 clear details regarding the process. The Data should include a graphical and/or tabular reproduction of the pie charts and bar graphs results each student received, as well as the class cumulative. Students have the option of requesting copies of other student’s individual data for comparison. The Results should describe the patterns they saw, both for their miniature groups and as a class. Students should also comment on oddities they noted in the data sets and speculate on possible sources. Statements should try to refer to graphs for emphasis, where possible. The Conclusions should include statements why they feel their analysis is correct, areas where the analysis could have been improved, and suggest further potential for research. The best report will be forwarded to UND for review. Include the photo/video documentation with the submittal.

**ADDITIONAL RESOURCES:**

**EPA: Climate Change**. This site has fact sheets and links to the most frequently asked questions about climate change, such as Why is it happening? and What can I do about it? <http://www3.epa.gov/climatechange/>

**NASA Global Climate Change, Vital Signs of the Planet.** This site has animated displays of satellite imagery showing evidence of global warming and links to news articles describing the satellite imagery animations <http://climate.nasa.gov/>

**NOVA “Warnings from the Ice”** This video explains how ice core studies record global climate change <http://www.pbslearningmedia.org/asset/ess05_vid_climatechange/>

**Penn State Public Broadcasting Geospatial Revolution Episode 4, Chapter 1: Monitoring a Changing Climate.** This video explains how satellite and other remotely sensed data is collected to track climate change. <http://geospatialrevolution.psu.edu/episode4/chapter1>