



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
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## Political Debates over Climate Change

Curriculum Unit 15.03.06  
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### Rationale

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Education has been divided among different disciplines for years, but true learning takes place when students recognize the relevance of learning across disciplines. My colleague, Alva Hanson, and I co-teach a science and English course called "Science through Literature." Within this course, we cover science topics with a high concentration on non-fiction literature. Having both of us in the class, with different skills and abilities, helps the students learn the information on a deeper and more relevant level.

We teach under-credited and overage students at New Horizons School for Higher Achievement in New Haven, Connecticut. Our students have been placed in our alternative high school for reasons of truancy, criminal records (court-ordered students), childcare issues, and serious behavior issues. Most of them live in poverty-ridden neighborhoods and find school to be their only "safe-haven," but fall way below their reading/writing grade levels, so schoolwork is difficult and frustrating. My job is to teach the New Haven English curriculum at an appropriate level, so none of my students feel over- or under-challenged, which is quite difficult when I have a class of fifteen students and reading/writing levels vary from "grade 2" through "post-high school." Another huge challenge is their truancy issues. In my class of fifteen I may only see the same three students every other day, so the units and lessons I plan cannot span over a couple days because I will only be forced to play "catch-up" each day with the students who walk into the classroom after three days of being absent.

Our co-taught class has focused on topics of disease and viruses, astronomy, genetics; and now, we want to focus on climate change. Climate change, however, is a huge topic, which our students find boring and irrelevant. What we hope to accomplish is an awareness of how climate change affects each of our students and what they can do to help make changes. With the upcoming election, we want to help our students become scientifically- and politically-literate when it comes to the issue of climate change.

In order to do this successfully, we will first focus on the foundational information they need to understand the issue and how it started. Once the foundation has been built, we will focus on political debates and news articles. In addition, we will utilize our school's garden, the Long Island Sound, and other nearby amenities to conduct experiments and hands-on learning. Our students will conclude the unit with a debate of their own—defending or arguing against the notion of climate change.

Thomas Hager's *The Alchemy of Air* will be the first text we examine. We will not read the entire book, but will take sections of it to explore the history of climate change. This book travels through the beginning of the twentieth century when humanity was facing a global disaster. The fast-growing population was facing a mass starvation fear. Two of the world's most brilliant scientists, Fritz Haber and Carl Bosch, were called in hopes of finding a solution. These two scientists developed, what is now known as the Haber-Bosch process. Their invention still feeds us today, but at a significant price. The Haber-Bosch process was also used to make gunpowder and high explosives, which killed millions during the two world wars. As a result of their invention, today we face massive nitrogen pollution. To follow this text, we will focus on James Hansen's TED Talk "Why I must speak out about climate change," Scientific American's "Behind the Hockey Stick," "The Nitrogen Cycle," and "What Do Farmers Think about Climate Change?"

## Overview

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This unit will span over the course of one marking period, which is about 45 days of teaching. Each week, a new text will be the focus. To accompany the text, during-reading lessons and activities will take place. During the final two weeks of the marking period, students will work to formulate their arguments in preparation for their final project—an in-class debate.

## Importance of Interdisciplinary Co-Teaching

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### Definition of Co-Teaching

Co-teaching is a model that emphasizes collaboration and communication among all members of a team to meet the needs of all students. Two teachers are equally qualified and equally responsible for the teaching within the joint class. For interdisciplinary co-teaching, the two teachers should be skilled in two different subjects (for example, Alva Hanson is a science teacher and Patricia Sorrentino is an English teacher). The needs for successful co-teaching are communication between co-teachers, administrative support, similar philosophies, and common planning time.

### The Purpose of Co-Teaching

These co-teachers come together for a common purpose, typically to meet a wide range of learners more effectively. These teams may have a long-term agenda for working together (an entire academic year) or short-term agendas for working together (completing a unit together, science project, etc.). The purpose for interdisciplinary co-teachers is to bring two teachers with different skill sets into one class for better classroom management, higher student engagement, and deeper learning for students.

### How Co-Teaching Works

Two teachers from different disciplines have to decide they can work well with each other inside and outside of the classroom. Then they have to decide what topic they want to teach and what parts of the unit each teacher is responsible for. The most importance piece of scheduling for this type of co-taught class is knowing

which course credit each student needs. For example, in Alva Hanson and Patricia Sorrentino's co-taught class, students who need a science credit are enrolled in Mr. Hanson's class, while students who need an English credit are enrolled in Ms. Sorrentino's class. Once the pair of teachers is established, students are enrolled, and a unit is developed, the class can run smoothly. Students will be able to learn the material with an in-depth focus of two different disciplines.

## Why Climate Change?

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There are many topics that the Science curriculum teacher and English curriculum teacher could cover in a science and English-merged course; however, climate change is so widely discussed there is an acute need for students to be "in the know" on this politically charged topic. Our students, who are mostly Black and Latino, will encounter more of the negative effects of climate change because of their poverty and inner-city living. Climate change is attributed to the burning of fossil fuels, which adds to pollution. Our students tend to live in the areas where there is a higher concentration of pollution due to power plants, cars, and industry; thus, our students are more likely to breathe in dirty air than people of a higher economic status living in the suburbs. The burning of fossil fuels is changing our climate, which heightens the possibility of super storms. For example, Hurricane Katrina hit the people of New Orleans with a vengeance. These impoverished citizens are still waiting, 10 years later, to be compensated for their losses. Due to their economic status and lack of resources, they were unaware of the danger headed their way and did not heed the evacuation warnings. We want to educate our students, so they do understand the severity of super storms, so if they are ever faced with that type of catastrophe, they are prepared. Also, many of our students suffer from asthma and other health issues related to pollution. In addition, urban areas tend to have heat islands, which attribute to further health risks. If we can use this unit to educate our students about climate change and its effects, we can help make them better consumers and better voters. While we are concerned about the environment, we are also concerned about human rights—all citizens should be able to breathe in clean air and have clean energy options.

### Health Effects and the Marginalized

To introduce the negative health effects associated with climate change, our students will view the graph on the <http://www.cdc.gov/climateandhealth/effects/> website. The graph outlines the different health issues associated with climate change, such as asthma and cardiovascular failure. The graph shows what specifically causes these health issues; for example, poor water and food supply can and do lead to malnutrition. For comprehension of the graph, I will ask my students to create a cause and effect flow chart outlining climate change's negative effects on the earth thus leading to harmful health effects on humans. Since this class is also focused on science, I will have my students write the cause and effect flow chart with "if...then" statements (much like a hypothesis).

To bring this issue closer to home for our students, we will view a CBS video. The video, accessible on <http://www.cbsnews.com/news/obama-on-impact-of-climate-change-on-health-of-one-of-his-family-members/>, deals with President Obama's direct correlation with climate change; he blames climate change for one of the many causes of asthma. Many of our students suffer from asthma, much like Obama's daughter. Asthma has been proven to be on the rise due to climate change. Asthma can severely affect one's quality of life. To best understand asthma, the science co-teacher will explore the structure of the lung, how the respiratory system

works, and how asthma affects the functions of both (see Potential Causes of Climate Change by Alva Roy Hanson Jr.).

Once the science co-teacher has explored those topics with our students, we will ask them to conduct a survey of their friends and family to find out how many have been diagnosed with asthma. This survey will provide data for our students to analyze. While the science co-teacher will chart the data with the students, I will ask them to create informational posters to hang around the school building. The posters' theme will be inform others of how climate change increases the risk of asthma and how many of our students' family and friends have asthma.

## Foundational Knowledge

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### Atmosphere, Basics of Climate Change, and Energy

Prior to reading any texts, we need our students to understand the structure of the atmosphere, what greenhouse gasses are, and how energy is created. The science co-teacher will use a variety of methods to explain the compositional layers of the atmosphere and the major characteristics of each layer. He will expose our students to the foundation of climate change. In addition, he will teach them about how energy is created and the difference between renewable and nonrenewable energy. He will plan a field trip to the Yale Power Plant for our class and create a shake-a-gen with our students in class (see Potential Causes of Climate Change by Alva Roy Hanson Jr.).

While the science co-teacher covers those topics, I will be responsible for helping my students keep a journal of all the necessary words and their definitions important to understand. A helpful tool is the <http://www.epa.gov/Region5/climatechange/posters/climate-change-vocab-list.pdf> website. The important words are:

- Anthropogenic: Having to do with man, or caused by humans.
- Atmosphere: The mixture of gases and aerosols – the air – that surrounds the Earth in layers protecting us from the sun's powerful ultraviolet (UV) radiation, and even from meteors. The atmosphere extends up to 20 miles above the Earth.
- Carbon Dioxide (CO<sub>2</sub>): A heavy, colorless atmospheric gas. It is emitted during respiration by plants and by all animals, fungi, and microorganisms that depend either directly or indirectly on plants for food. CO<sub>2</sub> is also generated as a byproduct of the burning of fossil fuels or vegetable matter. CO<sub>2</sub> is absorbed from the air by plants during their growth process. It is one of the greenhouse gases.
- Carbon Footprint: The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO<sub>2</sub>). Your carbon footprint is the sum of all emissions of CO<sub>2</sub> (carbon dioxide), which were induced by your activities in a given time frame. Usually a carbon footprint is calculated for the time period of a year.
- Climate: The average weather for a particular region over an extended time period. In other words, climate is the weather you would expect to have in a particular region.
- Climate Change: Major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from both natural processes and/or human activities.
- Emissions: The act or instance of discharging (emitting) something into the air, such as exhaust that

comes out of the tail pipe of a car or a smokestack.

- **Energy:** Power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines.
- **Fossil Fuels:** Fossil fuels are natural substances made deep within the Earth from the remains of ancient plants and animals. Over time, heat and pressure turned the decomposing remains into substances that act as fuel to release energy when burned. Coal, oil, and natural gas are the three main fossil fuels.
- **Global Carbon Cycle:** The cyclical movement of carbon within the biosphere. Carbon is primarily removed from the air by plants during photosynthesis and by dissolving in bodies of water. Carbon is generally returned to the air via biological respiration, decomposition of organic matter, volcanic activity and society's industrial activities, including the combustion of fossil fuels.
- **Global Warming:** An increase in the Earth's average temperature, which in turn causes changes in climate. This increase in temperature is caused mainly by an increase in greenhouse gases like carbon dioxide and methane in the atmosphere.
- **Greenhouse Effect:** The effect produced by greenhouse gases allowing incoming solar energy to pass through the Earth's atmosphere, but preventing most of the outgoing heat from escaping into space. The natural greenhouse effect is necessary to maintain life on earth, as it keeps the Earth 60°F warmer than it would be without the presence of these gases.
- **Greenhouse Gases:** Gases such as water vapor, carbon dioxide, methane, and nitrous oxide that allow incoming solar radiation to pass through the Earth's atmosphere, but prevent most of the outgoing infrared (heat) radiation from the surface and lower atmosphere from escaping into outer space. Greenhouse gases are present in the atmosphere from both natural processes and human activities such as burning fossil fuels and driving cars.
- **Methane:** An odorless, colorless, flammable gas, CH<sub>4</sub>, the major constituent of natural gas, that is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds.
- **Climate Change Mitigation:** Refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior.
- **Renewable Energy:** Energy from a source that is not depleted when used, such as wind or solar power.
- **Solar Radiation:** The energy emitted by the sun. This energy can be seen and felt as heat in the sun's rays.
- **Urban Heat Island:** A region of warmer air temperature (relative to the surrounding countryside) in a metropolitan area. Urban heat islands have been documented to exist in cities with as few as a thousand inhabitants.
- **Weather:** The specific condition of the atmosphere at a particular place and time. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season.

## Classroom Activities

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### During-Reading Lessons/Activities

After the science co-teacher leads our students to learn about fertilizers, test our school's garden soil, and inquire about fertilizers used to help the garden grow, I will facilitate a research-based activity with our students (see Potential Causes of Climate Change by Alva Roy Hanson Jr.). Many environmentalists, who are

eager to educate our youth about the important issues, have created researched-based educational websites and learning tools. One fantastic tool is [www.TheScienceofSoil.com](http://www.TheScienceofSoil.com). Educators can find PowerPoint presentations, hands-on activities, and demonstrations for free to enhance their classroom. Within this website, there is an important PowerPoint presentation titled, “Nourishing the Plant in the 21st Century.”

Objectives for this lesson:

- Appreciate how soil properties contribute to plant health
- Recognize that nutrient deficiencies limit crop productivity
- Understand the role of fertilizer in growing crop plants and in restoring nutrient balance to agricultural soils
- Relate crop productivity to the need for more farmland
- Describe challenges associated with feeding the world’s growing population

After this PowerPoint presentation is concluded, students will write a persuasive letter to the garden coordinator at our school, making suggestions for environmentally-friendly cropping. Within their persuasive letter, students must make three suggestions and provide the research behind each suggestion, in order to educate the garden coordinator and prove their new learnings about sustainable food productivity.

James Hansen’s TED Talk “Why I must speak out about climate change,” Scientific American’s “Behind the Hockey Stick,” and “The Nitrogen Cycle” will be the next informational texts we read. All three texts provide more of the foundational knowledge our students need to help them understand the issue. “Why I must speak out about climate change” discusses Hansen’s knowledge of climate change and his fears for the future. He outlines the evidence, which points to climate change and brings to light the possible negative effects. “Behind the Hockey Stick,” discusses Michael Mann’s highly criticized, but iconic hockey stick graph, which makes predictions for our world with the effects of global warming. Mann defends his scientific predictions, but receives push back from skeptics, such as the Greening Earth Society and the Tech Central Station Web site, because they obtain funds from petroleum interests. Petroleum is made from fossil fuels, so it is not in the interest of some to agree with global warming due to the financial implications. However, Mann’s prediction did not come true, which has led many skeptics of climate change to point to his graph with many questions. “The Nitrogen Cycle” discusses how a large majority of the population cannot utilize nitrogen. Nitrogen can only be used once specialized organisms fix it or when industrial processes take place. Fertilizers allow the nitrogen to be utilized, in order to farm; however, this is harming our environment. This article touches upon the issue of money, which is in control of everything—this brings us to the political issues connected to climate change. These two articles provide necessary information before we can move on to more in depth articles and debates.

### **During-Reading Lessons/Activities**

A big underlying topic in the three texts is CO<sub>2</sub>, so the science co-teacher will provide my students with an understanding of what CO<sub>2</sub> is and have them conduct experiments to experience what CO<sub>2</sub> does (see Potential Causes of Climate Change by Alva Roy Hanson Jr.). After he shows them a foundational video about CO<sub>2</sub>, and before he conducts experiments with our students, I will read an information text about CO<sub>2</sub> with them. The text titled, “Overview of Greenhouse Gases” will provide our students with necessary information about how CO<sub>2</sub> is used and what its effects are. The article can be found on the following website: [www.epa.gov/climatechange/ghgemissions/gases/co2.html](http://www.epa.gov/climatechange/ghgemissions/gases/co2.html).

While we read the text, students will be required to look up the definitions of words in the text I have

underlined, so they can fully comprehend the reading. This text provides three areas where CO<sub>2</sub> is utilized: electricity, transportation, and industry, and a graph of how these sources contribute to the CO<sub>2</sub> emissions in the United States. After reading the article, I will ask students to look up three countries of their choice (besides the United States) and find how much CO<sub>2</sub> is emitted due to electricity, transportation, and industry. Once they have found their three graphs, they will have to make observations about their three graphs and the one from the text. They will have to present comparisons and contrasts between the graphs for their peers.

The objective of this activity is to help our students begin thinking about how the United States compares to other countries and their CO<sub>2</sub> emissions. All of this information will help them begin to research for their final debate topic. This activity also helps them begin to think about human effects on the environment and become conscious of their own use of electricity, transportation, and industry. Overall, we want our students to become mindful consumers and users, so this activity skims the surface of our overall goal.

Scientific American's "What Do Farmers Think about Climate Change?" will be the text to follow because it deals with our current effects of climate change and how we, as a society, are impacted. This article outlines farmers' beliefs of the reality of climate change. However, these farmers are skeptical of those who are trying to make necessary changes because of the political influence. This text is another resource to help us discuss the political implications of climate change and will help direct us to understanding the political debates for the 2016 electoral debates.

### **During-Reading Lessons/Activities**

While we read the above article, we will also focus on the website, [www.epa.gov/climatechange/science/causes.html](http://www.epa.gov/climatechange/science/causes.html), in order to gain more insight. While the science co-teacher will watch the embedded videos and describe, in great detail, the charts and illustrations (see Potential Causes of Climate Change by Alva Roy Hanson Jr.), I will be conducting a close-reading activity with the website's article.

The article is divided into four sections: 'Earth's temperature is a balancing act,' 'The Greenhouse Effect causes the atmosphere to retain heat,' 'Changes in the sun's energy affect how much energy reaches Earth's system,' and 'Changes in reflectivity affect how much energy enters Earth's system.' In addition to having students determine the meaning of words based on context, they will have to write the main idea for each of the four sections. This skill will allow them to boil down a lot of content into smaller ideas, which will be easier for them to remember. Finding the main idea of non-fiction is also an important skill for our students to master, so this activity will be useful for their ELA skills and competencies.

To culminate the unit, students will be asked to participate in a formal debate. The class will be divided into two groups—those defending climate change and those arguing against climate change. As an English teacher, my job will be to provide the students with the skills to analyze and assess the information. I will guide them in understanding the non-fiction texts. The science co-teacher will focus on the science of the issue. He will provide them with guidance in understand the effects of climate change.

## Ways to Address Climate Change

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Prior to the final project, the science co-teacher will discuss mitigation of climate change with our students, so they can be better consumers (see Potential Causes of Climate Change by Alva Roy Hanson Jr.).

### Final Project

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To culminate the unit, students will be asked to participate in a formal debate. The class will be divided into two groups—those defending climate change and those arguing against climate change. I will focus on the assessing and analytical skills of reading non-fiction texts. She will provide them with guidance in formalizing an argument and defending it for the debate.

### “The Great Debate”

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A debate is a discussion or structured challenge about an issue or a resolution. A formal debate involves two firm sides: one supporting a resolution and one opposing it. These types of debates are bound by rules, which are agreed upon prior to the event. Debates may be judged or monitored, in order to declare a winning side. Debates are commonly used to explore and resolve issues and problems through a presentation of facts, opinions, and questions. In the context of a classroom, the debate will be monitored for student engagement and judged based on the strongest arguments presented.

However, for this particular classroom activity, it will be important to make sure the students understand that just because one side has “won” the debate based on better arguments and stronger facts presented, it does not mean that is the correct answer to the debate’s question. For example, if the side opposing the notion of climate change wins the classroom debate, it does not mean that climate change is nonexistent. It is important to make sure students understand this point because America has been torn apart through the years over debates. A debate is simply a forum for people to express their opinions, present facts, ask important questions, and think about a topic beyond its surface.

#### Structure for Debate

A formal debate usually involves three groups: one supporting a resolution (affirmative team), one opposing the resolution (opposing team), and those who are judging the quality of the evidence and arguments and the performance in the debate (the two classroom teachers). The affirmative and opposing teams will consist of about eight members each, while the science and English co-teachers will judge the debate. In addition to the three specific groups, there will be an audience made up of other teachers, administration, and other students. The topic for the debate will be—Is there enough scientific evidence to prove climate change is real?

Debate Preparation:



- Develop the resolution to be debated
  - The debate will be centered around the question, “Is there enough scientific evidence to prove climate change is real?”
- Organize the teams
  - Have students choose which side they wish to be on: the affirmative team or the opposing team
- Establish the rules of the debate, including timelines
  - Each student must present at least one fact and either one opinion or ask one question (they will have 90 seconds to present their fact and another 90 seconds to share their opinion or ask one question)
  - To end the debate, a representative from each side will have three minutes to wrap up their team’s arguments, facts, opinions, and questions
- Research the topic and prepare logical arguments, gather supporting evidence and examples for position taken, and anticipate counter arguments and prepare rebuttals
  - Throughout the entire marking period, students will have a notebook to compile facts and research about the topic
- Team members plan order and content of speaking in debate
  - The teams will have to decide who speaks first, second, third, etc. They will also have to decide who the representative of each team will be
- Prepare room for debate
  - The chairs should be set up in two rows, which face each other with the judges (teachers) and audience sitting around the debaters
- Establish expectations, if any, for assessment of debate
  - The students will be judged on their engagement, ability to speak their opinion, argument, question, etc., counter their challengers’ arguments, and accuracy of their facts

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## Appendix

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This unit utilizes the English Language Arts Common Core State Standards. Since my students are "lower-leveled," the 9-10 standards are incorporated.

- ELA-Literacy.RL.9-10.1: Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- ELA-Literacy.RL.9-10.2: Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
- ELA-Literacy.W.9-10.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- ELA-Literacy.W.9-10.1.a: Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
- ELA-Literacy.W.9-10.1.b: Develop claim(s) and counterclaims fairly, supplying evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level and concerns.
- ELA-Literacy.W.9-10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3 above.)
- ELA-Literacy.W.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 9-10 here.)
- ELA-Literacy.W.9-10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- ELA-Literacy.W.9-10.7: Conduct short as well as more sustained research projects to answer a question

(including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

- ELA-Literacy.W.9-10.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

This unit focuses heavily on the 21<sup>st</sup> Century Competencies. All of these competencies will be incorporated into the students' classroom activities and projects.

- Problem Solving and Critical Thinking:
  - Reason effectively
  - Make insightful judgments and decisions
  - Solve problems
- Accessing and Analyzing Information
  - Use research tools to access and evaluate information from multiple sources
  - Organize and synthesize information using multiple methods
- Communication and Collaboration
  - Articulate ideas clearly and effectively to a variety of audiences using multiple modes
  - Communicate effectively and work productively with others
- Creativity and Innovation
  - Demonstrate originality and inventiveness in work by, implementing and sharing new ideas
- Initiative, Leadership and Accountability
  - Set and meet high standards and goals for one's self and others
  - Manage time and resources to produce high quality results in a timely manner
  - Take responsibility for one's own learning
- Citizenship and Responsibility
  - Exercise empathy and respect for diverse cultures and perspectives
  - Contribute to and take responsibility for the larger community

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