

**6th Grade Science Unit 1: Setting Things in Motion**  
**Pop-Out 1: Engineering for Equity**

**Pop-Out Essential Question:** *How can we use engineering to provide more access for people with disabilities?*

**Introduction**

The Pop-Outs are designed to provide a two to three day Pop-Out lesson that allows students to apply what they’ve learned in the unit to delve deeper into larger scientific considerations around diversity, equity, cultural responsiveness, and justice. Such considerations touch on concepts like the use of engineering to promote equity and justice, issues of representation in the engineering field, unequal access to genetic testing, and equity in climate change policy. They may be used at any point throughout the unit as the content is intertwined with, yet independent of, the unit concepts; however we offer a timing recommendation for each Pop-Out.

Throughout this unit, students explore how their bodies are able to make objects move. In this Pop-Out, they think about people with disabilities whose bodies might not allow them to make objects move in these ways. After researching examples in which engineers have improved the lives of those living with disabilities, it is their job to consider how they might make their project activity more accessible to people with disabilities. By also exploring the new concept of Universal Design, students will consider how engineering can be used not only to promote equity but also justice.

This Pop-Out can be used at any point in the unit after students have decided on their activity at the end of the Lift-Off Task.

**Alignment Table**

<p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Engineering can be used to improve the lives of all people, especially people with disabilities.</li> <li>• Engineering can be used to promote equity and justice in society.</li> </ul>
<p><b>Understandings about the Nature of Science (from NGSS Appendix H)</b></p> <ul style="list-style-type: none"> <li>• Science is a way of knowing used by many people, not just scientists.</li> <li>• Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination, and creativity.</li> <li>• Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism and openness to new ideas.</li> <li>• Advances in technology influence the progress of science and science has influenced advances in technology.</li> </ul>
<p><b>Science, Technology, Society, and the Environment (from NGSS Appendix J)</b></p> <ul style="list-style-type: none"> <li>• Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.</li> <li>• Science and technology drive each other forward.</li> <li>• The uses of technologies are driven by people's needs, desires and values; by the findings of scientific research; and by differences in factors such as climate, natural resources, and economic conditions.</li> </ul>
<p><b>Equity and Group work</b></p> <ul style="list-style-type: none"> <li>• Work together to research examples of solutions that engineers have designed to improve the lives of people with disabilities.</li> <li>• Work together to brainstorm and present a technology that would allow more people to do their</li> </ul>

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project activity.
<b>Language</b> <ul style="list-style-type: none"> <li>Engage with a variety of written and visual resources.</li> <li>Orally communicate information to the class.</li> <li>Reflect on the difference between the vocabulary terms “equality”, “equity” and “justice”.</li> </ul>

**Learning Goals**

In this Pop-Out, students will consider how engineering can promote equity by providing more access to people with disabilities. More specifically, the purpose is to:

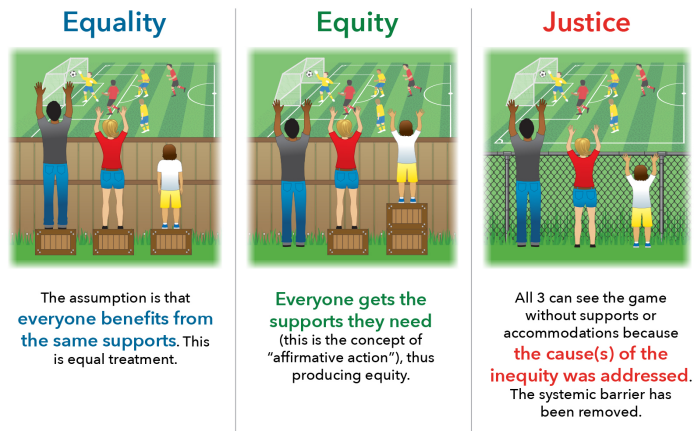
- Consider how their project activity might be difficult or impossible for some people.
- Research examples of solutions that engineers have designed to improve the lives of people with disabilities and brainstorm a potential solution to make their own project activity more accessible.
- Create a presentation to share their solution with the class.
- Learn about a new approach to engineering called Universal Design.
- Reflect on the difference between equity and equality and justice and consider how engineering can help to promote equity and justice in society.

**Content Background for Teachers**

In this Pop-Out, students are asked to grapple with the reality that not everyone’s bodies work in the same way. A significant portion of the global population experiences a disability at some point. People with disabilities often face unique barriers in their daily lives. However, engineering can and has played a large role in breaking down some of these barriers. For example, the invention of wheelchairs has improved some people’s mobility and the invention of hand-operated controls have allowed those with reduced motor control in their legs to ride a bike or drive a car. Thus, engineering has played a large role in promoting equity by providing more access to people with disabilities.

Universal Design is a concept that takes this even a step further. It refers to the design of a product or environment so that it can be accessed and used to the greatest extent possible by all people, without the need for adaptation or specialized design. Under this concept, all people’s needs are met, including those with disabilities. One familiar example is the dropped curb you can now find at most street corners where pedestrian activity is expected. A dropped curb refers to the ramp graded down from the top surface of a sidewalk to the surface of an adjoining street. Almost any pedestrian can use this kind of curb.

At the end of this task, students are given the language of “equality”, “equity”, and “justice” in order to reflect on engineering through a lens of social justice. The diagram to the right, which is provided to students in the *Evaluate*, is a great resource to prompt a discussion with your students about these concepts.



<http://agentsofgood.org/wp-content/uploads/2017/04/Equality-vs-Equity-Illustration3.jpg>

**6th Grade Science Unit 1: Setting Things in Motion****Pop-Out 1: Engineering for Equity****Vocabulary**

- Engineering
- Technologies
- Disability
- Accessibility
- Universal Design
- Equity
- Equality

**Time Needed (Based on 45-Minute Periods)**

3 Days

- Engage: 0.5 period
- Explore: 1 period
- Explain: 0.5 period
- Elaborate: 0.5 period
- Evaluate and Reflection: 0.5 period

**Materials**

- Unit 1, Pop-Out Student Version

Engage

- Projector and Speaker for Video

Explore

- Computers with Internet Access for Research

Explain

- Any Supplemental Presentation Materials

Elaborate

- Projector and Speaker for Video

**Instructions****Engage**

1. To introduce the Pop-Out, we recommend reading the introduction in the Student Guide aloud to the class. This helps them to see the connection to the unit as well as orient them to what they will be doing in this task.
  - Note: you may have to explicitly define some academic terms if they are new for students, such as “engineer”, “technologies”, “disability”, and “accessible”.
2. To engage students, project the following video to the class, which shows how a group of students engineered a solution for a child with a disability: <https://www.youtube.com/watch?v=TwCLOBEUXjs>.
  - Questions are provided in the Student Guide to guide their partner discussion. We recommend sharing out a few impressions in a class-wide discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).

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3. In the video, the students were able to engineer a solution that allowed the child to do a range of different activities. Now students will use this as inspiration to consider the activity they picked for their culminating project. Here they ask themselves: What about people who aren't able to do my activity because of a disability?
  - To guide their initial thought process, have groups of students discuss and respond to the two prompts in their Student Guide: In what ways might your activity be difficult or impossible for some people to do? Brainstorm some initial ideas of what you could engineer (design) so that more people could do this activity.
  - These prompts are meant to prime students for the upcoming task and access prior knowledge. Emphasize to students that there are no right answers at this point. They will have plenty of time to do some research and brainstorm more ideas throughout the task.

**Explore**

1. Students saw one example of how students (just a few years older than them) were able to engineer a solution that helped a child with a disability do activities that require movement. However, there are hundreds of other examples. Engineers have been working for years to design solutions that make it easier for people with disabilities to do everyday activities, including those that involve moving objects.
2. In this *Explore*, students will research examples of solutions that engineers have designed to give people with disabilities more access to different activities.
  - As students research, they should record their notes in the table in their Student Guide. Encourage students to record at least four examples. If they find more, they may want to focus on the examples that most closely relate to their culminating project activity. They will hopefully use some of these ideas as inspiration to come up with a way to make their own project activity more accessible to people with disabilities.
  - Student research will vary greatly depending on what they search for. Some examples they might find are: hand brakes in cars, hand pedals for bikes, wheelchairs, wheelchairs operated by facial movements rather than hands, a moving ball that makes noise as it accelerates, a computer that uses eye tracking instead of a mouse, a material to hold jars in place so they can open them with one hand, etc.
  - If students are struggling to find any examples, provide them with some search terms to choose from. For example: "products that help people with disabilities", "technologies that help people with movement disabilities", "sports equipment for people with disabilities", etc.
    - The following TedEd playlist may also be a good resource for students:  
[https://www.ted.com/playlists/372/designing\\_for\\_disability](https://www.ted.com/playlists/372/designing_for_disability).
3. Once students have researched and taken notes on a few relevant solutions, they can use this as inspiration to brainstorm a potential solution to make their Culminating Project activity more accessible to someone with a disability.
  - Students should brainstorm in their teams and describe their solution in their Student Guides.
  - These do not have to be completely realistic solutions. The goal is just for them to be considering how activities can be made more accessible to more people.

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4. Since students will be working in groups to do their research and brainstorm a solution, we recommend assigning group roles. You may use whatever roles you prefer, but we recommend the use of the Facilitator, Materials Manager, Harmonizer, and Recorder.
  - Ask the Facilitator to read the directions, make sure everyone understands the task, and facilitate the research and brainstorm processes.
  - Ask the Materials Manager to handle any resources needed to complete the task, including computers and associated computer applications (ie. internet browser).
  - Ask the Harmonizer to make sure that everyone contributes their ideas and that everyone’s voice is heard.
  - Ask the Recorder to make sure the group is recording their research and ideas in their Student Guide.

**Explain**

1. In this *Explain*, student groups have an opportunity to share their solution with their classmates.
2. Give student groups time (approx. 10 minutes) to prepare a casual 1-2-minute presentation, using the criteria in their Student Guide.
  - a. They can convey their ideas in a number of different ways (video, slides, poster, etc.), but we recommend not spending a lot of time on developing these presentations.
3. After students present, we recommend debriefing the presentations as a class by discussing how some of these solutions might be used for many of the different activities.

**Elaborate**

1. Thus far, many of the solutions students researched and presented were likely engineered to make an existing activity more accessible to people with disabilities. In this section of the task, students think about a new approach to engineering called Universal Design, in which the goal is to engineer products and environments to be usable by all people from the very beginning.
2. As a class, project the following video that describes Universal Design: <https://www.youtube.com/watch?v=bVdPNWMGyZY>. You may choose to show the entire video; however, if you are short on time, we recommend showing the video from 5:05 to 10:10.
3. In partners, have students discuss the questions in their Student Guide. We recommend debriefing these in a class-wide discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).
  - Other examples of Universal Design that they may come up with are: bumps near entrances to large stores like Safeway or Target to indicate approaching an entrance/exit, video games with in-game tutorials or “novice” early levels rather than instruction booklets, dropped sidewalk curbs at street corners.

**6th Grade Science Unit 1: Setting Things in Motion****Pop-Out 1: Engineering for Equity****Evaluate**

1. Over the course of this task, students have seen examples of how engineering has the capacity to not only promote equity but also justice. This *Evaluate* gives students the language of “equality”, “equity”, and “justice” in order to reflect on what they have learned in this task through this particular lens.
2. Students independently work to answer the reflection questions in their Student Guide.
  - If students are struggling to interpret the images for equality, equity, and justice, you may choose to do the first question together in groups or as a class. However, we do encourage students to complete at least the last two questions individually so they have a chance to individually reflect.
3. Bring the whole class together for a group discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). Use the questions in the Student Guide to guide the discussion.
  - There are no “correct” answers. The goal of this discussion is for students to begin to consider the world from a social justice perspective, in this case using engineering as a mechanism. We hope students may see the adaptive technology examples as engineering that promotes equity and the Universal Design examples as engineering that promotes justice.

**Assessment**

1. You may collect the student guide handout and assess using:
  - *Criteria of your choice.* We recommend focusing on the reflection questions from the *Evaluate* section to provide a sense of how students are considering engineering through a social justice perspective.
  - This can be a formative tool to look for trends in student demonstrations of skills and practices. You can then use this formative data to inform future instruction.

## 6th Grade Science Unit 2: Extreme Living

### Pop-Out 2: Equity in STEM

**Pop-Out Essential Question:** *Is there diversity in STEM and why does it matter?*

#### **Introduction**

In Unit 2, students design a product that makes it more comfortable for people to live in regions with extreme climates. In doing so, they are engaging in the work of engineers. In Pop-Out 1, students thought about how engineering can be used as a tool for equity and justice. However, within the field of engineering itself, there are some serious equity issues.

In this Pop-Out, students explore the lack of racial and gender diversity in STEM fields like engineering. They begin the task by thinking about why diversity is important and beneficial for STEM fields. They then examine data that shows that despite these benefits, there is a woeful underrepresentation of women and minorities in STEM majors and jobs. Students then read an article that poses some reasons for this lack of diversity so they are able to brainstorm some strategies to address the issue.

This Pop-Out can be used at any point in the unit after students have been introduced to their Culminating Project at the end of the Lift-Off Task.

#### **Alignment Table**

<p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Diversity in the STEM workforce is important for better problem-solving in the field, technological advancement for our society, and more equitable incomes across race and gender lines.</li> <li>• There is a lack of diversity in the STEM field, specifically in terms of gender and race.</li> <li>• By identifying specific potential causes, targeted strategies can be used to address the lack of diversity in STEM.</li> </ul>
<p><b>Understandings about the Nature of Science (from NGSS Appendix H)</b></p> <ul style="list-style-type: none"> <li>• Science knowledge is cumulative and many people, from many generations and nations, have contributed to science knowledge.</li> <li>• Men and women from different social, cultural, and ethnic backgrounds work as scientists and engineers.</li> <li>• Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination, and creativity.</li> <li>• Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.</li> <li>• Scientific knowledge is constrained by human capacity, technology, and materials.</li> </ul>
<p><b>Science, Technology, Society, and the Environment (From NGSS Appendix J)</b></p> <ul style="list-style-type: none"> <li>• The uses of technologies are driven by people's needs, desires and values; by the findings of scientific research; and by differences in factors such as climate, natural resources, and economic conditions.</li> </ul>
<p><b>Equity and Groupwork</b></p> <ul style="list-style-type: none"> <li>• Work together to analyze and interpret diversity data and brainstorm strategies to address a lack of diversity.</li> </ul>

**6th Grade Science Unit 2: Extreme Living****Pop-Out 2: Equity in STEM**

- Respectfully discuss varying opinions and ideas with peers.
- Consider multiple perspectives when discussing issues of equity and diversity.

**Language**

- Communicate ideas verbally in class discussions and small groups.
- Use academic vocabulary in writing and oral discussions, such as STEM, diversity, minorities, gender, and race.

**Learning Goals**

In this Pop-Out, students will examine data showing diversity in STEM fields and consider potential causes and solutions. More specifically, the purpose is to:

- Consider why diversity might be beneficial to the work done in STEM fields.
- Examine data on gender and racial diversity in STEM majors and jobs.
- Describe the lack of diversity in STEM, using data as evidence.
- Identify potential causes for a lack of diversity and use causes to brainstorm solutions.
- Reflect on why diversity in STEM is an important issue and the best ideas to address the lack of diversity.

**Content Background for Teachers**

Diversity in STEM fields has the capacity to create a more equitable society and increase innovation by bringing in more diverse perspectives. However, at present we see far fewer women and underrepresented minorities (URM) at both the college and career level. Women and underrepresented minorities face hurdles that have nothing to do with their abilities. Because of biases in our culture, some may be less likely to see themselves in STEM fields and are often not encouraged to pursue these fields. Daunting entry barriers and a lack of academic support prevent those without a specific education background from pursuing a STEM degree. Even once in the field, women and underrepresented minorities face harsh challenges, such as cultural stereotypes, discrimination, and harassment. To learn more, consult the *Explore Research Cards* and *Explain Article*, as well as the sources listed below, which were used in the construction of this task.

- <https://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/>
- <https://inside.collegefactual.com/stories/women-vs-men-in-stem-degrees>
- <https://www.sciencegenderequity.org.au/gender-equity-in-stem/>
- <https://blackengineeringphd.org/>
- <https://www.nae.edu/69743/Engineering-Diversity-Fixing-the-Educational-System-to-Promote-Equity>
- <https://www.nature.com/articles/d41586-018-02175-y>

**Academic Vocabulary**

- Diversity
- STEM
- Underrepresented Minorities
- Gender
- Bias
- Harassment
- Representation



## 6th Grade Science Unit 2: Extreme Living

### Pop-Out 2: Equity in STEM

- Access
- Discrimination

#### **Time Needed (Based on 45-Minute Periods)**

3.5 Days

- Engage: 0.5 period
- Explore: 1.0 period
- Explain: 0.5 period
- Elaborate: 1.0 period
- Evaluate and Reflection: 0.5 period

#### **Materials**

- Unit 2, Pop-Out Student Version

Explore

- 4 Research Cards (1 Set Per Group or 2-3 Per Station)

Elaborate

- Article, “Why Are We Seeing a Lack of Diversity in STEM?” (1 per student)
- Poster and Markers or Whiteboard Space

#### **Instructions**

##### **Engage**

1. To introduce the Pop-Out, we recommend reading the introduction in the Student Guide aloud to the class. This helps them to see the connection to the unit as well as orient them to what they will be doing in this task.
  - Here students are introduced to the term STEM—Science, Technology, Engineering, and Math—which they have likely heard before. Make sure students understand what this term means before moving forward since it is used frequently throughout the task.
  - This introduction also includes data about STEM job growth (up 79% in last 30 years) and salary comparison to non-STEM jobs. The goal is for students to see why many people might want to work in STEM professions. You may want to continue to return to this point throughout the task as students learn which groups of people are not accessing these jobs and these high salaries.
    - Source: <https://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/>
2. Before students look at any data, we want them to think about why diversity might be important for STEM jobs like engineering in the first place. To do this, we engage their prior knowledge of their experiences as engineers.
  - Have students individually think about their experience when they have acted as an engineer that is designing a solution to a problem. To guide their reflection, they fill out the two questions in their Student Guide.
  - Then have students discuss in partners whether they think diversity is important in STEM and why.

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- We recommend sharing out opinions in a class-wide discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). While there are no correct answers, we hope that many students will reflect that working with a diverse group of people often creates better products in the design process.
3. If you are looking for more background information to prepare you for this class discussion, you might consider the following three sources. All sources discuss how the advancement of our society depends on a diverse STEM workforce because this brings more talent and more perspectives for better problem-solving and products.
- <https://www.wired.com/brandlab/2015/05/5-numbers-explain-stem-diversity-matters-us/>
  - <https://blogs.scientificamerican.com/voices/diversity-in-stem-what-it-is-and-why-it-matters/>
  - <https://www.talentlyft.com/en/blog/article/244/top-10-benefits-of-diversity-in-the-workplace-infographic-included>

**Explore**

1. Now that students have discussed ways in which diversity is good for STEM, they can explore how diverse STEM fields actually are.
2. Students will need access to the four *Research Cards* for this section of the task. You may choose to provide each group of students with a set of *Research Cards* or you could set up research stations for each *Research Card* for students to move between. If you do choose to do research stations, we recommend providing 1-2 copies of each *Research Card* at a station and depending on your class size, making multiple stations for the same *Research Card*.
3. In groups, students will analyze each *Research Card*. Each *Research Card* has a graph of data that shows gender or racial representation in STEM majors or jobs.
  - On each *Research Card*, we have provided graph analysis questions. Encourage students to discuss these to help them understand the graphs.
  - As students analyze the graphs, they should record their notes in the table in their Student Guide. They should be describing what they think each graph is about as well as answering a few discussion questions that help them pull out the key conclusions from each graph.
    - You may want to model this graph analysis process using *Research Card 1*.
  - Optional: Conduct a class-wide discussion to share key takeaways from each *Research Card*, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).
4. Since students will be working in groups, we recommend assigning group roles. You may use whatever roles you prefer, but we recommend the use of the Facilitator, Materials Manager, Harmonizer, and Recorder.
  - Ask the Facilitator to read the directions and make sure everyone understands the task.
  - Ask the Materials Manager to handle any resources needed to complete the task, including *Research Cards*.
  - Ask the Harmonizer to make sure that everyone contributes their ideas and that everyone’s voice is heard.

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- Ask the Recorder to make sure the group is recording their notes in their Student Guide.

**Explain**

1. In this *Explain*, students are tasked with individually explaining the amount of diversity in STEM to another person. To scaffold this explanation, a graphic organizer is provided in their Student Guides. This graphic organizer asks them to make a claim and support their claim with evidence of gender diversity (Graphs 1 and 2) and evidence of racial diversity (Graphs 3 and 4). Encourage students to look back at their graphic organizer in the *Explore* as a resource for the rows of evidence.
2. A student sample explanation is provided below:

Claim About Diversity in STEM	<i>According to data, there is a lack of both gender and racial diversity in STEM.</i>
Evidence of Gender Diversity (Describe what you saw in Graphs 1 and 2)	<i>Research Cards 1 and 2 show that there is not much gender diversity in STEM. In Research Card 1, I learned that there are many more men (63%) than women (37%) with a STEM college major. This is unlike non-STEM majors where there are more women than men. In Research Card 2, I learned that across all education levels in STEM, there are more males than females. The gap gets bigger at higher levels of STEM, like Level E, which is 87% male and 13% female.</i>
Evidence of Racial Diversity (Describe what you saw in Graphs 3 and 4)	<i>Research Cards 3 and 4 show that there is not much racial diversity in STEM. Research Card 3 showed that 69% of STEM jobs are held by white people and that across all STEM jobs, Blacks and Hispanics are underrepresented. Research Card 4 showed that in Engineering, there is a high percentage of white professors and a very low percentage of African-American and Hispanic professors. This gets worse as you go up in Professor Rank.</i>

3. Optional: provide sentence frames to help students construct their explanation. For example:
  - According to data, there is \_\_\_ of diversity in STEM.
  - Research Cards \_\_\_ and \_\_\_ show that there is \_\_\_\_\_ (a lot/not a lot – pick one) of gender diversity in STEM fields.
  - Research Cards \_\_\_ and \_\_\_ show that there is \_\_\_\_\_ (a lot/not a lot – pick one) of racial diversity in STEM fields.
  - In Research Card \_\_\_, I learned that
  - Research Card \_\_\_ showed that
  - This is compared to...
  - The difference gets larger...
4. We recommend conducting a quick class debrief before moving on to the *Elaborate* to make sure everyone has come to the same conclusion about gender and racial diversity in STEM. Again, use equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).

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**Elaborate**

1. Students can now see that diversity in STEM is an issue, but in order to think about strategies to address this, they need to better understand some of the factors that may be causing this phenomenon.
2. Pass out the article, “Why Are We Seeing a Lack of Diversity in STEM?”. Students should read and annotate this article using whatever strategy you typically use in your classroom.
3. With a partner, students fill out the table in their Student Guide in which they describe the three possible reasons for the lack of diversity identified in the article. They then brainstorm at least one strategy to address each of these factors. A student sample chart is provided below. These are just some example strategies students may come up with, but there are many more.

Reasons For the Lack of Gender and Racial Diversity in STEM	<i>Not seeing themselves as scientists and engineers because of messages and examples they get growing up.</i>	<i>Not accessing the necessary courses in high school to qualify for a STEM major in college.</i>	<i>Discrimination in STEM workplaces.</i>
Strategies to Bring More Women and Underrepresented Minorities into the STEM Field	<ul style="list-style-type: none"> <li>- Providing more examples of females and people of color in STEM</li> <li>- Programs for girls and children of color to participate in STEM activities (ie. STEM clubs, science and engineering camps).</li> <li>- STEM toys that appeal to females</li> </ul>	<ul style="list-style-type: none"> <li>- Counselors trained to encourage girls and students of color to take courses that prepare them for STEM majors</li> <li>- Math and science tutoring or support classes in K-12 and college for females and students of color</li> <li>- High school info sessions on STEM pathway</li> <li>- Summer college prep camps</li> </ul>	<ul style="list-style-type: none"> <li>- Actively recruiting more females and people of color for STEM majors and STEM faculty positions</li> <li>- Clear company policies on discrimination and harassment</li> <li>- Bigger consequences for harassment and discrimination</li> <li>- Peer support groups for women and people of color in STEM</li> </ul>

4. Share ideas out as a class, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). Create a poster of potential strategies they come up with to address this issue.
5. If students want to know more about strategies that are actually being used, here are some resources:
  - o <https://engineering.stanford.edu/students-academics/equity-and-inclusion-initiatives/about-equity-and-inclusion-initiatives>
  - o <https://engineering.berkeley.edu/about/equity-and-inclusion/>
  - o <https://www.nae.edu/69743/Engineering-Diversity-Fixing-the-Educational-System-to-Promote-Equity>

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### Pop-Out 2: Equity in STEM

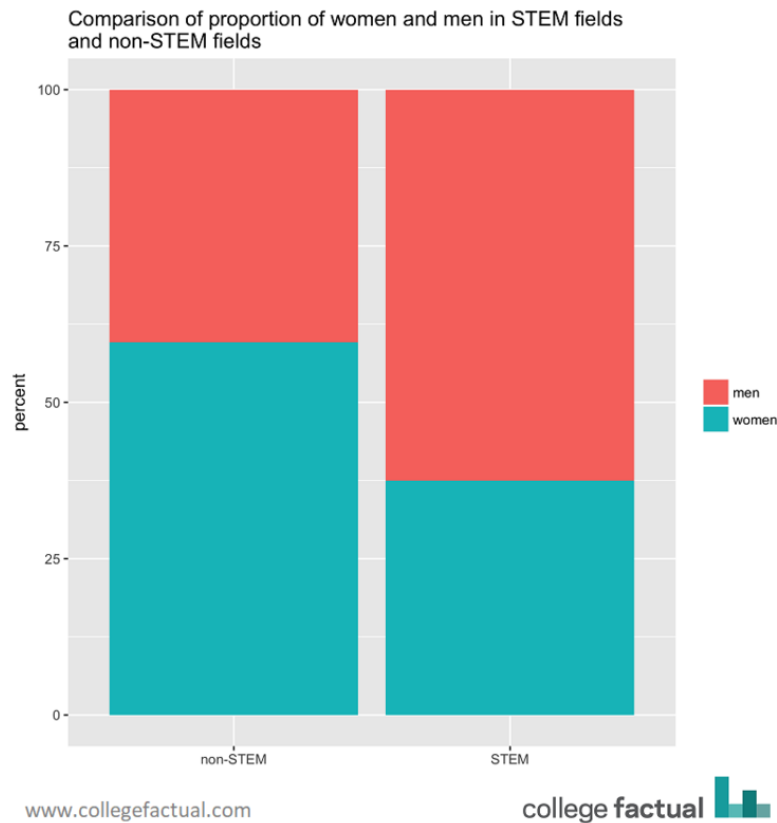
- <https://www.theatlantic.com/ideas/archive/2019/11/how-umbc-got-minority-students-stick-stem/602635/>

#### Evaluate and Reflect

1. Over the course of this task, students have explored the lack of diversity in STEM. This *Evaluate* gives students a chance to reflect on why this matters, what should be done about it, and how this might personally affect them.
2. Students independently work to answer the reflection questions in their Student Guide.
3. Bring the whole class together for a group discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). Use the questions in the Student Guide to guide the discussion.
  - There are no “correct” answers. However, we hope that students see why a lack of diversity in STEM is a problem for both equity and the success of the field. By ending with questions about potential strategies to address the issue and the support they might personally need, we aim to leave this task with a solutions-oriented mindset.

#### Assessment

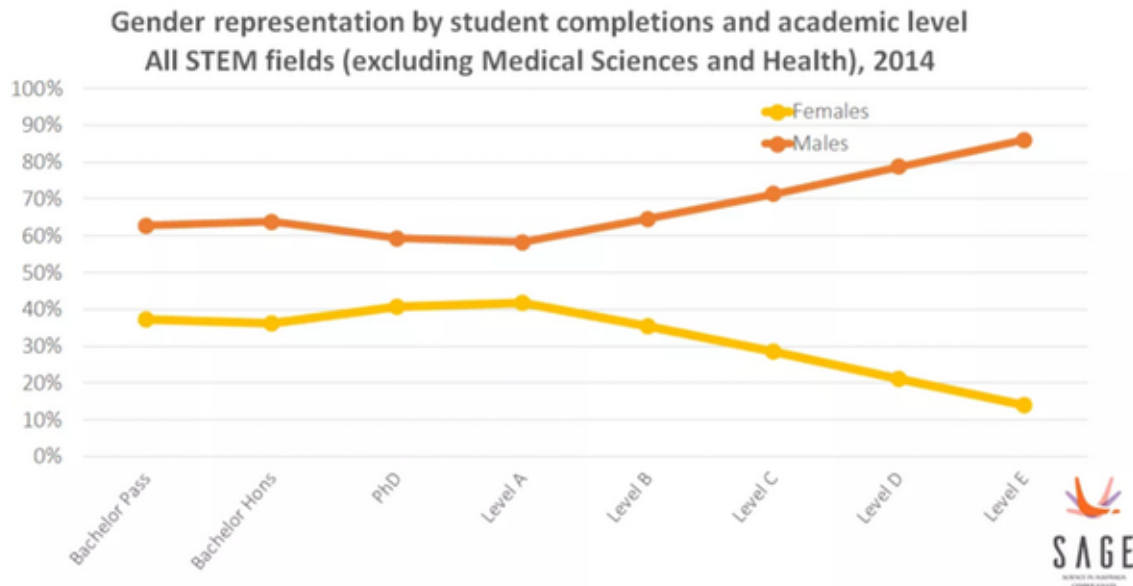
1. You may collect the Student Guide handout and assess using:
  - *Criteria of your choice.* We recommend focusing on the *Explain* graphic organizer, the *Elaborate* table, or the *Evaluate and Reflect* questions to understand how students are making sense of the significance of the lack of diversity in STEM, including causes and potential strategies to address it.
  - This can be a formative tool to look for trends in student demonstrations of skills and practices. You can then use this formative data to inform future instruction.

**Research Card 1: Women and Men With a College Major in STEM vs. Non-STEM Fields****Graph Analysis Questions:**

1. In the graph: what color represents women? What color represents men?
2. Compare the percentages of the blue and red sections: Is there a higher female-to-male ratio in non-STEM or STEM fields?
3. In the STEM bar, compare the blue and red sections: Are there more women or men majoring in STEM fields?

Source: <https://inside.collegefactual.com/stories/women-vs-men-in-stem-degrees>

## Research Card 2: Females and Males at Different Levels in STEM Education



Gender distribution of student completions and academic staff in STEM fields (excluding Medical Sciences and Health). Bachelor Pass and Bachelor Hons = Undergraduate Degrees and PhD = Doctorate Degree. Level A = Junior Academic and Level E = Senior Professor with a gradient of levels in between (Levels B – D).

### Graph Analysis Questions:

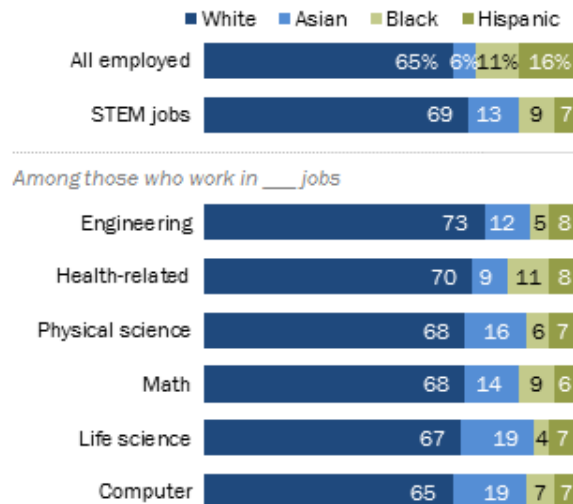
1. In this graph: what is the lowest level of STEM education on the x-axis? What is the highest level of STEM education on the x-axis?
2. In this graph: what color line represents females? What color line represents males?
3. Compare the yellow and orange lines across all education levels: Are there more females or males in each STEM education level?
4. Look at where the yellow line is at the lowest percentage and the orange line is at the highest percentage: At what level of STEM education is there the most difference between the percentage of females and males?

Source: <https://www.sciencegenderequity.org.au/gender-equity-in-stem/>

### Research Card 3: Race Representation in STEM Professions

#### Blacks and Hispanics underrepresented across most STEM job clusters

*% of employed in each occupational group who are ...*



Note: Based on employed adults ages 25 and older. Whites, blacks and Asians include only non-Hispanics. Hispanics are of any race. Other and mixed race non-Hispanics are not shown. Engineering includes architects. STEM stands for science, technology, engineering and math.

Source: Pew Research Center analysis of 2014-2016 American Community Survey (IPUMS).

"Women and Men in STEM Often at Odds Over Workplace Equity"

PEW RESEARCH CENTER

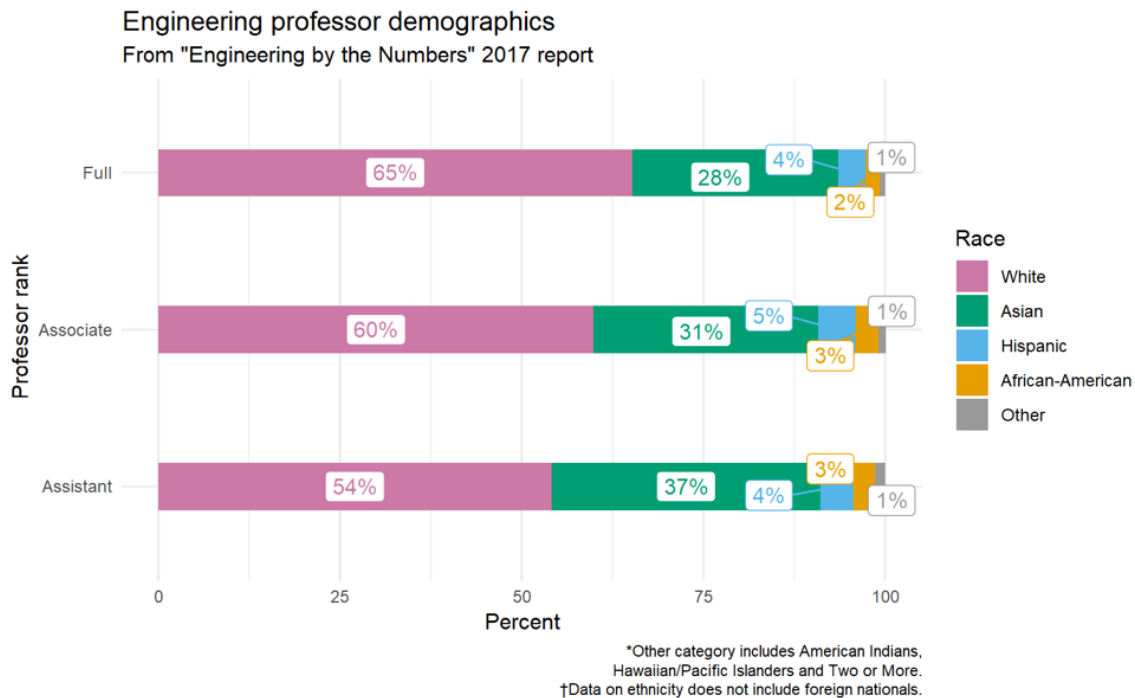
#### Graph Analysis Questions:

1. In this graph: what color bar represents each racial group?
2. Look at the "STEM jobs" bar:
  - a. Which racial group holds the largest percentage of STEM jobs?
  - b. Which racial group holds the lowest percentage of STEM jobs?
  - c. Is it a big difference?
3. Look at the bars that relate to specific STEM jobs:
  - a. Which STEM field has the most White people?
  - b. Which STEM field has the fewest underrepresented minorities (Black and Hispanic people)?

Source: <https://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/>



## Research Card 4: Race Representation of Engineering Professor Ranks



**Description of Professor Ranks:** Assistant Professor = entry-level and often temporary position; Associate Professor = mid-level, permanent position; Full Professor = highest-level, permanent position at highest level of promotion

### Graph Analysis Questions:

1. In this graph: what is the lowest level of Professor Rank on the y-axis? What is the highest level of Professor Rank on the y-axis?
2. In this graph: what color bar represents each racial group?
3. Look at the size of each color bar at each Professor Rank level:
  - a. Which racial group is most represented (largest bar) at each level?
  - b. Which racial group is least represented (smallest bar) at each level?
  - c. Is there a big difference?
4. Look at where the pink bar is the largest and the other color bars are the smallest: At which Professor Rank is there the most difference between white representation and representation of other races?

Source: <https://blackengineeringphd.org/>

## Article: Why Are We Seeing a Lack of Diversity in STEM?

The data makes it clear that the majority of people studying STEM majors in college and pursuing STEM jobs are white and male. Why is there a serious underrepresentation of women and minorities in STEM?

**Representation:** First, we need to think about who is likely to see themselves as a scientist or engineer. Can you imagine an adult saying that building a robot or building a car are “boy’s activities”? How often do you see robot toys next to dolls in the girl’s toy aisle at Target? Young girls get these kinds of messages all the time, so many have a hard time picturing themselves doing STEM jobs like these later in life. Also, if children grow up rarely seeing examples of female, black, or Hispanic scientists and engineers, it is harder for them to envision it as a future for themselves. This may lead to more white and male children and fewer female and minority children being interested in pursuing STEM careers.

**Access:** The second answer to this question lies in the pathway to entering the STEM field, which starts in schools just like yours. Most STEM majors require rigorous math and science courses in high school. Unfortunately females and underrepresented minorities are less likely to take these courses. This may be because a bias against their race or gender keeps adults from encouraging students to take these courses. Some schools don’t even offer these courses. If these female and minority students do not get to take these classes, they have fewer opportunities to become a STEM major in college. This leads to fewer women and minorities with STEM jobs in the future.

**Discrimination:** Even for those that do make it into a STEM major or a STEM job, women and minorities can still face some major challenges. Many women and minorities in STEM experience discrimination because of their gender or race. They might earn a lower salary, get passed over for a job or promotion, or be treated as if they are less competent or capable. Added to that, women also often experience sexual harassment. All these factors often discourage some people from entering or staying in the field.

Now that we have three potential reasons for the lack of gender and racial diversity in STEM, what can we do about it?

Adapted From the Following Sources:

- <https://www.nae.edu/69743/Engineering-Diversity-Fixing-the-Educational-System-to-Promote-Equity>
- <https://www.nature.com/articles/d41586-018-02175-y>

## 6th Grade Science Unit 3: Nature Via Nurture

### Pop-Out 3: Genetic Testing – Access Denied

**Pop-Out Essential Question:** *How is genetic testing important for our health and who has access to it?*

#### **Introduction**

In Task 3, students collect evidence related to the nature vs. nurture debate, allowing them to discover that it is not an either-or question. Both genetics and environment are often at play. In the unit project, students are applying this concept to algae. However, this idea is relevant to humans too. To explore the genetic variations that lead to different traits and diseases, scientists and medical professionals use genetic testing.

In this Pop-Out, students explore the process of genetic testing, which has been around for decades but has been on the rise in recent years. First, students observe case studies of various patients to see what genetic testing can do and why it is important for health outcomes. Once they understand the importance of genetic testing, they then learn that despite the benefits, there are some populations that are less likely to receive genetic testing. In doing so, they are able to consider how this might further contribute to widening health disparities in our society.

We recommend introducing this Pop-Out after students have completed Task 3 of this unit since it builds on their understanding of genetic and environmental influences.

#### **Alignment Table**

<p><b>Content</b></p> <ul style="list-style-type: none"> <li>Genetic testing is important for health outcomes by helping doctors to prevent, diagnose, and treat more diseases.</li> <li>Minority and low-income populations are much less likely to receive genetic testing.</li> <li>Genetic testing threatens to increase health disparities as access to these expensive tests further widens the gap.</li> </ul>
<p><b>Understandings about the Nature of Science (from NGSS Appendix H)</b></p> <ul style="list-style-type: none"> <li>Advances in technology influence the progress of science and science has influenced advances in technology.</li> <li>Science knowledge can describe consequences of actions but is not responsible for society’s decisions.</li> </ul>
<p><b>Science, Technology, Society, and the Environment (From NGSS Appendix J)</b></p> <ul style="list-style-type: none"> <li>Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.</li> <li>Science and technology drive each other forward.</li> <li>The uses of technologies are driven by people's needs, desires and values; by the findings of scientific research; and by differences in factors such as climate, natural resources, and economic conditions.</li> </ul>
<p><b>Equity and Groupwork</b></p> <ul style="list-style-type: none"> <li>Work together to analyze patient stories and create a presentation.</li> <li>Respectfully discuss varying opinions and ideas with peers.</li> <li>Consider multiple perspectives as you discuss issues of equity.</li> </ul>

**6th Grade Science Unit 3: Nature Via Nurture****Pop-Out 3: Genetic Testing – Access Denied****Language**

- Pull out relevant information from a video patient story.
- Communicate ideas orally in a presentation, class discussions, and small groups.
- Read and annotate an article.
- Use new academic vocabulary in writing and oral discussions, such as genetic testing, access, health disparities, low-income, and minority.

**Learning Goals**

In this Pop-Out, students will explore the importance of genetic testing for health outcomes and examine how it threatens to widen health disparities. More specifically, the purpose is to:

- Engage with the example of perfect pitch to think about why knowing one’s genetic makeup might be helpful.
- Explore patient stories to learn more about what genetic testing can do for health outcomes.
- Present patient stories to share and learn about the different benefits of genetic testing.
- Learn about who has access to genetic testing and consider what this means for health disparities.
- Reflect on how genetic testing can be beneficial but can also result in increased health disparities.

**Content Background for Teachers**

Genetic testing has been on the rise in recent years, helping medical professionals to prevent, diagnose, and treat certain diseases. However, research has shown that physicians are less likely to provide genetic testing for low-income and minority groups. Why? Researchers have found that there are several contributing factors to this phenomenon. Genetic testing is an extremely expensive test and even private insurance companies require patients to meet very specific criteria to provide any coverage. This restricts access to a large number of low-income and minority individuals. Regardless of cost, research also shows that minority and low-income groups are less likely to receive information about genetic testing from their physicians or be referred for genetic testing. There is also often a much higher distrust in the medical system that prevents many from using genetic testing. This decreased access to genetic testing threatens to widen the already large health disparities that currently exist. To learn more, consult the patient stories in the *Explore* and the article in the *Explain*, as well as the sources listed below, which were used in the construction of this task.

- <https://www.nature.com/articles/gim200997>
- <https://www.healthcarediver.com/news/genetic-testing-threatens-to-widen-health-disparities/424144/>

**Academic Vocabulary**

- Genetic Testing
- Health Outcomes
- Minority
- Low-Income
- Access
- Health Disparities

## 6th Grade Science Unit 3: Nature Via Nurture

### Pop-Out 3: Genetic Testing – Access Denied

#### Time Needed (Based on 45-Minute Periods)

3 Days

- Engage: 0.5 period
- Explore: 0.5 period
- Explain: 1.0 period
- Elaborate: 0.5 period
- Evaluate and Reflection: 0.5 period

#### Materials

- Unit 3, Pop-Out Student Version

Explore

- Computers or Tablets w/ Audio

Explain

- Optional Presentation Materials

#### Instructions

##### **Engage**

1. To introduce the Pop-Out, we recommend reading the introduction in the Student Guide aloud to the class. This helps them to see the connection to the unit as well as orient them to what they will be doing in this task.
2. Before students explore more serious case studies that showcase the benefits of genetic testing, we want to engage them with a lighter scenario – the hereditary and environmental influences on perfect pitch.
  - Introduce students to this phenomenon by reading the first two paragraphs of the *Engage* in their Student Guides.
3. Have students discuss and respond to the questions in their Student Guide in pairs.
  - The first question allows them to connect to their prior knowledge from the unit by identifying this as a nature via nurture example.
  - The second question begins to get them thinking about how this example shows a motivation to know more about your genetic makeup (ie. Wouldn't it be great to know your child has this gene variation so they could make sure they get early musical training to reach their full potential?).
  - The third question introduces them to genetic testing as a test that is so expensive, only some people may have access. This is an important idea they will return to throughout the task.
  - We recommend sharing out these ideas in a class-wide discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).
4. Sources:
  - <https://www.ucsf.edu/news/5879/genetically-set-perfect-pitch-you-might-be-without-early-training-d>
  - <https://www.pbs.org/wgbh/nova/genome/debate.html>

**6th Grade Science Unit 3: Nature Via Nurture****Pop-Out 3: Genetic Testing – Access Denied****Explore**

1. While knowing whether you have the genetic variation for perfect pitch may not seem like the biggest priority, there are many other scenarios in which knowing your genetic makeup can be very important for health outcomes. To find out about our genetic makeup, we use genetic testing.
  - As a class, review the definition for genetic testing in their Student Guides: Genetic testing is a medical test that looks for any differences in your DNA code that can cause you to develop and/or pass on certain diseases.
2. In groups, students will pick from the list of five patients in their Student Guides and watch the video to learn more about what genetic testing can do. The goal of this exercise is for students to see the importance of genetic testing for health outcomes.
  - Distribute a computer or tablet to each group.
  - As students watch their video, they should take notes in the box in their Student Guide. They will use these notes to prepare a presentation that they will share with the class. You may want to review the requirements for their presentation so students know what to look for in their videos.
3. Since students will be working in groups, we recommend assigning group roles. You may use whatever roles you prefer, but we recommend the use of the Facilitator, Materials Manager, Harmonizer, and Recorder.
  - Ask the Facilitator to read the directions and make sure everyone understands the task.
  - Ask the Materials Manager to handle any resources needed to complete the task, including the computer/tablet.
  - Ask the Harmonizer to make sure that everyone contributes their ideas and that everyone’s voice is heard.
  - Ask the Recorder to make sure the group is recording their notes in their Student Guide.

**Explain**

1. Genetic testing is important for many different purposes. Since groups analyzed different patient stories, they can learn about some of these different purposes from each other.
2. As a class, review the presentation requirements for their patient story presentations. Then give students time to prepare their presentation. Keep in mind these should be brief and informal. You may provide any parameters for presentation format and materials that you prefer.
  - Since students will be working in groups again, we recommend assigning group roles and changing up assignments from the *Explore*.
3. You may have each group present or select five groups that cover the range of all 5 patient stories.
4. After hearing presentations on all the patients’ stories, conduct a discussion using the following facilitating questions: What are the different benefits of genetic testing? Why is genetic testing important for health outcomes?
  - We recommend first giving time for students to discuss as a group and then using equity sticks to share out in a class-wide discussion (See “How To Use This Curriculum” for more details).

**6th Grade Science Unit 3: Nature Via Nurture****Pop-Out 3: Genetic Testing – Access Denied**

- Students should discuss that there are many benefits to genetic testing, such as diagnosing diseases, informing treatment decisions, tailoring prescription regimens that work best, and identifying risk to either prevent or mitigate disease.

**Elaborate**

1. Students have seen that genetic testing can play an important role in people’s health. This section of the task looks at genetic testing through an equity lens. Since genetic testing is so beneficial, it seems like genetic testing should be available to everyone. But is it in practice?
2. Have students individual read and annotate the article in their Student Guides, “Who Has Access to Genetic Testing?”. Students should annotate this article using whatever strategy you typically use in your classroom.
3. With a partner, students then discuss the article and answer the questions in their Student Guide.
4. Share ideas out as a class, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). You may use the questions in their Student Guide to facilitate this discussion.
  - From the article, students should be able to pull out the information that minority and low-income groups are less likely to receive genetic testing due to a few contributing factors. We hope that the discussion questions help them to make the connection that if certain groups are not accessing genetic testing, this can lead to worse health outcomes for those groups, which is a serious equity issue.

**Evaluate and Reflect**

1. Over the course of this task, students have explored benefits of genetic testing and who has access to these benefits. This *Evaluate* gives students a chance to reflect on how genetic testing has the potential to have a positive and also negative impact on our society.
2. Students independently work to answer the reflection questions in their Student Guide.
3. Bring the whole class together for a group discussion, using equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details). Use the questions in the Student Guide to guide the discussion.
  - There are no “correct” answers. However, we hope that students see that while genetic testing has great benefits for health outcomes, the difference in access for different groups has the potential to increase already large health disparities in our society.
4. The last question asks students to end with a more solutions mindset by beginning to consider how genetic testing can be used in a more fair way. If you would like students to leave this task with some concrete solutions, we recommend reading and adapting the following article:  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5100696/>.

**6th Grade Science Unit 3: Nature Via Nurture**  
**Pop-Out 3: Genetic Testing – Access Denied**

**Assessment**

1. You may collect the Student Guide handout and assess using:
  - *Criteria of your choice.* We recommend focusing on the *Elaborate* class discussion or the *Evaluate and Reflect* questions to understand how students are making sense of the potential for genetic testing to widen health disparities.
  - This can be a formative tool to look for trends in student demonstrations of skills and practices. You can then use this formative data to inform future instruction.



**6th Grade Science Unit 4: A Warmer World**  
**Pop-Out 4: A Call for Equity in Climate Action**



**Pop-Out Essential Question:** *Why does Greta Thunberg call for equity in climate action?*

**Introduction**

In this unit, students are exploring what causes global warming and what it means for the ways humans are impacting environments and organisms around the globe. This Pop-Out asks students to consider the broader category of climate change, including who the largest contributors are, who are the most vulnerable to the impacts, and how these factors should affect how we move forward with climate action.

In this Pop-Out, students are introduced to a young environmental activist they have likely heard of before—Greta Thunberg. Greta Thunberg mentions equity almost every time she speaks about climate action. In this task, it is your students’ job to examine data in the form of an interactive map to decide for themselves whether they think equity should be a key component to climate action and why. They then learn that countries around the world attempted to collaborate on climate action in the 2015 Paris Climate Agreement, but the US has since made plans to withdraw from the agreement. In response, they consider whether they agree with this decision and what they might include in their own climate agreement to make sure it is fair and equitable.

We recommend introducing this Pop-Out after students have completed Task 3 since this Pop-Out builds on students’ knowledge of both the causes and impacts of global warming.

**Alignment Table**

<p><b>Content</b></p> <ul style="list-style-type: none"> <li>● Climate action is a massive undertaking that will require the support and cooperation of all countries around the world.</li> <li>● Equity should be considered in any climate action plan to account for historical responsibility and current capacity.</li> </ul>
<p><b>Understandings about the Nature of Science (from NGSS Appendix H)</b></p> <ul style="list-style-type: none"> <li>● Science knowledge can describe consequences of actions but is not responsible for society’s decisions.</li> </ul>
<p><b>Science, Technology, Society, and the Environment (From NGSS Appendix J)</b></p> <ul style="list-style-type: none"> <li>● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.</li> <li>● The uses of technologies are driven by people’s needs, desires and values; by the findings of scientific research; and by differences in factors such as climate, natural resources, and economic conditions.</li> <li>● Technology use varies over time and from region to region.</li> </ul>
<p><b>Equity and Groupwork</b></p> <ul style="list-style-type: none"> <li>● Work together to analyze data and draw conclusions from an interactive map.</li> <li>● Respectfully discuss varying opinions and ideas with peers.</li> <li>● Consider multiple perspectives as you discuss issues of equity.</li> </ul>
<p><b>Language</b></p> <ul style="list-style-type: none"> <li>● Use prior knowledge from other Pop-Outs to come to consensus on a definition for “equity”.</li> </ul>

## 6th Grade Science Unit 4: A Warmer World

### Pop-Out 4: A Call for Equity in Climate Action

- Pull out relevant information from multiple formats (audio, visual, etc.).
- Use data and reasoning to support and communicate claims.
- Read and annotate an article (*Optional*).
- Communicate ideas orally in partners, class discussions, and small groups.
- Use new academic vocabulary in writing and oral discussions, such as climate action, equity, emissions, consumption, at risk, vulnerable, and responsibility.

#### **Learning Goals**

In this Pop-Out, students will examine data to determine why there is a call for equity in climate action and what this means. More specifically, the purpose is to:

- Engage interest in the climate crisis and introduce climate justice using a speech by youth activist, Greta Thunberg.
- Explore an interactive map to discover who is most responsible for climate change and who is most vulnerable to the impacts.
- Vote on whether equity should be considered in climate action.
- Learn about the Paris Climate Agreement and what US withdrawal means for global climate action.
- Reflect on whether equity should be considered in climate action, best strategies, and what a student's personal role can be.

#### **Content Background for Teachers**

Climate change is the defining crisis of our time and in recent years has been recognized as the biggest policy issue our world faces. Because it is happening at such a rapid rate, action needs to be swift and rigorous, and this requires huge levels of cooperation amongst global powers. In climate negotiations, one topic that has arisen is the issue of equity—what exactly does this mean when it is applied to addressing climate change? Climate justice advocates argue that responsibility should be assigned in a fair way between rich and poor countries and between the rich and poor in those countries. In other words, those that caused most of the climate problem must do the most to fix it and provide the most support to those most impacted by it. Some countries in the United Framework Convention on Climate Change (UNFCCC) think equity should focus more on capabilities, or the capacity countries now have to deal with climate change. This is a nuanced issue made even more complicated when one considers the argument that countries of the Global North owe a climate debt to countries of the Global South from the centuries of economic exploitation that allowed them to develop. To learn more, consult the map interactive in the *Explore*, the optional article in the *Explain*, as well as the sources listed below, which were used in the construction of this task.

- <https://www.climatechangenews.com/2019/10/02/greta-thunbergs-call-equity-mean/>
- <https://www.wri.org/blog/2012/12/what-equity-context-climate-negotiations>

#### **Academic Vocabulary**

- Climate Action
- Equity or Climate Justice
- Emissions
- Consumption
- At Risk
- Vulnerability

## 6th Grade Science Unit 4: A Warmer World

### Pop-Out 4: A Call for Equity in Climate Action

#### Time Needed (Based on 45-Minute Periods)

3 Days

- Engage: 0.5 period
- Explore: 1 period
- Explain: 0.5 period (*add 0.5 period if using optional article*)
- Elaborate: 0.5 period
- Evaluate and Reflection: 0.5 period

#### Materials

- Unit 4, Pop-Out Student Version

Engage

- Projector and Speaker

Explore

- Computers or Tablets w/ Audio (make sure interactive map works on tablets)

Explain

- Optional: Article, *What Does Greta Thunberg’s Call for Equity Mean?*

Elaborate

- Projector and Speaker

#### Instructions

##### **Engage**

1. To introduce the Pop-Out, we recommend reading the introduction in the Student Guide aloud to the class. This helps students to see the connection to the unit as well as orient them to what they will be doing in this task.
2. Students have likely heard the name Greta Thunberg before in the news or social media. She offers a great way to engage students with this topic since she is not only a knowledgeable environmental activist, but she is also not much older than your students.
3. Show students a video of one of Greta’s speeches:  
[https://www.ted.com/talks/greta\\_thunberg\\_the\\_disarming\\_case\\_to\\_act\\_right\\_now\\_on\\_climate\\_change](https://www.ted.com/talks/greta_thunberg_the_disarming_case_to_act_right_now_on_climate_change)
  - We highly recommend showing the entire video once without students taking any notes, so they have a chance to simply absorb the information in the video. After this first showing, you may want them to answer the first discussion question in their Student Guides as they reflect on their first impressions.
  - Then show the video a second time. You can pause the video at strategic points so students are able to discuss and respond to the questions in their Student Guides. For example, pause at 3:10 for students to discuss Question 2b, pause at 5:30 for students to discuss Question 2c, and pause at 7:20 for students to discuss Question 2d.
    - A transcript is also available on the website as an optional scaffold.
  - Students should discuss these questions first in partners and then as a class. When sharing out these ideas in a class-wide discussion, use equity sticks to promote more equitable participation (See “How To Use This Curriculum” for more details).

## 6th Grade Science Unit 4: A Warmer World

### Pop-Out 4: A Call for Equity in Climate Action

#### Explore

1. In Greta Thunberg’s speech, she talked about a need for equity or climate justice in order for climate action to work on a global scale. Many climate activists say equity is the key to climate action. In this activity, it is students’ job to use data from an interactive map to figure out why.
2. Before students engage with the interactive map, you will want to make sure they have a common understanding of the term “equity”. Students have been using this term throughout the previous three Pop-Outs, so to leverage that prior knowledge, have groups of students reflect on what they learned in these Pop-Outs and discuss what they think equity means. They can record ideas or a common definition in the box in their Student Guide.
  - At this point, you may want to bring the class together to share ideas and come to consensus on a definition for equity. There is no perfect definition but we hope that students will share that equity isn’t necessarily about equal treatment but about differentiated treatment to achieve fair outcomes. In other words, some will get more or less, be responsible for more or less, so that everyone has the opportunity to get to a similar place. To facilitate this discussion, you may want to bring up examples from prior Pop-Outs to prompt their thinking.
3. In groups, students will use an online interactive Carbon Map to help them decide for themselves what might be fair in a climate action plan.
  - Distribute a computer or tablet to each group.
4. Students should type [carbonmap.org](http://carbonmap.org) into their web browser to access the interactive map. They first watch and listen to a brief introduction video that describes how the interactive works and then summarize what they learn from the introduction in their Student Guide. You may want to do this as a class so students are able to discuss ideas and questions before doing their own exploration in groups.
5. In the next step, students start to engage with the other maps in the interactive by looking at the “Population” Map and the “Wealth” Map. This is a pivotal moment in the Pop-Out as students first wrestle with this issue of inequality when they see that population size does not align with wealth. This will be the basis for them understanding why some of the other maps are the way they are.
  - We highly recommend doing this step together in a Think-Pair-Share format so you really take the time to establish this foundation with students.
  - To support this discussion, you may consider using the following facilitating prompts:
    - “Look at the Population map. Where does it grow biggest? What parts of the world, which continents or countries, seem to grow bigger than the rest? Why do you think this might be?”
    - “Now switch to the Wealth map. Which places become larger now? How could it be that the parts of the world with the most people aren’t also the places with the most wealth or money? If there are more people, shouldn’t there be more money? Why do you think this isn’t true?”
    - “In other Pop-Outs, you’ve talked a lot about this word ‘equity’... does the wealth map show equity or inequity in the way wealth is distributed around the world? When one

**6th Grade Science Unit 4: A Warmer World**  
**Pop-Out 4: A Call for Equity in Climate Action**

place or group of people has more wealth than expected or than average, we say they have a disproportionate amount of wealth. Do you think this is fair?"

6. The rest of the Maps will help students determine which continents are most responsible for climate change and which are most vulnerable to the impacts. In groups, students follow the directions in their Student Guide to analyze the interactive map. They should record data and discuss the *Questions to Consider* in the graphic organizer.
  - Optional: you may want to model the process using the first map type, so students can see how they should be comparing each map to the "Population" map, using the "This Map" box for additional information, discussing the *Question to Consider*, and filling out their graphic organizer.
7. Since students will be working in groups, we recommend assigning group roles. You may use whatever roles you prefer, but we recommend the use of the Facilitator, Materials Manager, Harmonizer, and Recorder.
  - Ask the Facilitator to read the directions, make sure everyone understands the task, and facilitate using the *Questions to Consider*.
  - Ask the Materials Manager to handle any resources needed to complete the task, including the interactive map on the tablet/computer.
  - Ask the Harmonizer to make sure that everyone contributes their ideas and that everyone's voice is heard.
  - Ask the Recorder to make sure the group is recording their notes in their Student Guide.
8. Below is a sample student table for reference:

Responsibility			
Map Type	Which continents are larger than their "Population" map size?	Which continents are smaller than their "Population" map size?	Questions to Consider
<b>Emissions</b>	<i>North America, Europe</i>	<i>South America, Africa, Oceania</i>	Compared to their population size, which continents contribute more to carbon <b>emissions</b> than you would expect? <i>North America and Europe</i>
<b>Consumption</b>	<i>North America, Europe</i>	<i>South America, Africa, Oceania, Asia</i>	Compared to their population size, which continents contribute more to carbon emissions from <b>consumption</b> than you would expect? <i>North America and Europe</i>
<b>Historical</b>	<i>North America, Europe</i>	<i>South America, Africa, Oceania</i>	Which two continents have contributed the most carbon emissions in the <b>past</b> ? <i>North America and Europe</i>

**6th Grade Science Unit 4: A Warmer World**  
**Pop-Out 4: A Call for Equity in Climate Action**



Vulnerability			
<b>People At Risk</b>	<i>Asia</i>	<i>North America, Europe, South America, Africa, Oceania</i>	Which continent has the most <b>people at risk</b> of feeling the effects of climate change in the future? <i>Asia</i>
<b>Sea Level</b>	<i>Asia</i>	<i>North America, Europe, South America, Africa, Oceania</i>	Which continent is most in danger of <b>sea level rise</b> (a result of climate change)? <i>Asia</i>
<b>Poverty</b>	<i>Africa, Asia</i>	<i>North America, Europe, South America, Oceania</i>	Which continents are most vulnerable to the impacts of climate change because of <b>poverty</b> ? <i>Africa and Asia</i>

**Explain**

1. Now that they have seen the data for themselves and discussed using the *Questions to Consider* to guide them, students should be ready to take a stance: do they think we need equity in climate action? Should everyone have equal responsibility in dealing with climate change or should some countries have more responsibility?
  
2. As a group, students will prepare for a class discussion in which they will a) vote on whether they think equity should be considered in climate action, b) use map data to justify why they think equity should or shouldn't be an essential piece of climate action, and c) explain what they think it would mean to have equity in climate action
  - o Emphasize to students that every person in their group should be prepared to share in this discussion.
  
3. When facilitating this class discussion, we highly recommend using equity sticks to call on students so you have equitable participation (See "How To Use This Curriculum" for more details).
  - o Below are some basic prompts you might use to facilitate initial discussion:
    - o Let's vote: Do you think equity should be considered in climate action?
    - o Why do you think equity should be considered in climate action? OR Why don't you think equity should be considered in climate action?
    - o What data from the map helped you come to your decision?
    - o What do you think it would mean to have equity in climate action? What would more responsibility and less responsibility actually look like in climate action?
  - o If students need a little more support than these basic prompts, here are some other facilitating questions you might use:
    - o According to the map, which continents have the most wealth and could afford to pay for a lot of the plans to reduce carbon emissions?
    - o Which continents are most responsible for carbon emissions, both now and in the past? Should these continents be required to take greater climate action?

## 6th Grade Science Unit 4: A Warmer World

### Pop-Out 4: A Call for Equity in Climate Action

- Which continents are the most vulnerable to climate change impacts? Are these the same countries that caused most of climate change? If not, what would be a fair route forward?
  - Even if they were responsible for the impacts they will suffer, is it ethical to leave them to deal with all these impacts themselves?
- 4. If you'd like to give students more detail on why there needs to be equity in climate action, what it has looked like so far, and what it could look like in the future, you may choose to have students read and annotate the optional article at the end of this Teacher Version: *What Does Greta Thunberg's Call for Equity Mean?* This great article by Nathan Thanki has been heavily adapted to make it more accessible for 6th-graders and to keep it relevant to this task. For the original version, visit: <https://www.climatechangenews.com/2019/10/02/greta-thunbergs-call-equity-mean/>

#### Elaborate

1. If climate action is going to be truly equitable, this is going to require a lot of global cooperation. In this *Elaborate*, students are introduced to the Paris Climate Agreement, which aimed to establish this sort of cooperation in 2015.
2. To learn more about where the US stands with the Paris Climate Agreement now, show students the following clip: <https://www.nytimes.com/2017/06/01/climate/us-paris-accord-what-happens-next.html> or [https://www.youtube.com/watch?v=MRCRiMNg\\_kM](https://www.youtube.com/watch?v=MRCRiMNg_kM)
3. Then conduct a class discussion using the questions in their Student Guide, as well as equity sticks to promote more equitable participation (See "How To Use This Curriculum" for more details). These questions help students analyze the video by thinking about the goals of the Paris Climate Agreement and what it means that President Trump has pulled out of the agreement. They can then discuss their opinions about this decision.
4. Lastly, have students discuss the separate question in their Student Guide. Here students bring the focus back to equity by thinking about what they would include in their own climate agreement to make sure it is fair and equitable. We recommend students share in groups and then as a class.

#### Evaluate and Reflect

1. Over the course of this task, students have examined data to decide for themselves whether equity should be a key focus in climate action. This *Evaluate* gives students a chance to reflect on why equity is so important as we address climate change and what the best ways might be to achieve it.
2. Students independently work to answer the reflection questions in their Student Guide.
3. Bring the whole class together for a group discussion, using equity sticks to promote more equitable participation (See "How To Use This Curriculum" for more details). Use the questions in the Student Guide to guide the discussion.

## 6th Grade Science Unit 4: A Warmer World

### Pop-Out 4: A Call for Equity in Climate Action

- There are no “correct” answers. However, we hope that students see that equity in climate action is essential not only for the success of climate action overall but also to hold certain countries accountable for their contributions.
4. The last question asks students to end by thinking about what they can personally do. We hope that by using the example of such a successful young activist like Greta, students will also see their potential to be agents of change despite their age.

#### **Assessment**

1. You may collect the Student Guide handout and assess using:
  - *Criteria of your choice.* We recommend focusing on the *Explain* and *Elaborate* class discussions or the *Evaluate and Reflect* questions to understand how students are making sense of the need for equity in climate action.
  - This can be a formative tool to look for trends in student demonstrations of skills and practices. You can then use this formative data to inform future instruction.



**What Does Greta Thunberg's Call For Equity Mean?**

by Nathan Thanki, 2/10/2019

Greta Thunberg has some memorable quotes that now adorn thousands of protest placards and Instagram posts. However, one word that she has mentioned consistently in her speeches has been given little to no attention, despite being the key to climate action. That word? Equity. To put it as simply as possible, equity is about fairness.

**Who Is Responsible For Most of the Carbon Emissions?**

You may have heard that 100 companies are responsible for 71% of emissions. Another way of looking at it is that the world's richest 10% hold 52% of the world's wealth and are responsible for 50% of emissions; the poorest 50% have only 8% of the world's wealth and are responsible for 10% of emissions.

Even though the US only makes up 4% of the world population, it is still responsible for around 15% of all current emissions. Broadly speaking, the countries of the Global North (the high-income countries in Europe and North America) have a combined 20% of the global population, but are responsible for around 80% of all emissions, ever.

Summary:

**Why is Equity Necessary in Climate Action?**

These countries of the Global North have grown rich and powerful because they have taken advantage of or stolen from the Global South (the low and middle-income countries in Asia, Africa, Latin America, and the Caribbean) over centuries. This has been accomplished through slavery and other kinds of economic exploitation, in which countries of the Global North have controlled and used countries of the Global South unfairly to make a profit.

This immense "historical responsibility" is the basis for what climate justice movements have come to call "climate debt". The Northern countries owe money to these Southern countries for denying them development opportunities and for the unfair impacts they suffer as a result of the warming caused by Northern countries.

Summary:

## Has There Been Equity in Climate Action?

Now, as Greta often reminds us, we need to get as close to zero emissions as possible, as soon as possible.

Our question of course is how to do this? Climate justice movements have long talked about what a fair response to the crisis looks like, and have maintained that responsibility should be assigned in a fair way between rich and poor countries, and between rich and poor people within countries. If we want to be fair, we could say that the wealthiest people (and companies) in the wealthiest countries have caused most of the climate problem and therefore must do the most to fix it. Those who have done the least, but who will be most affected by it, must be given more help.

The United Nations Framework Convention on Climate Change (UNFCCC) also makes clear that all countries must contribute to climate action based on both their historical responsibility and what they can currently afford. These are what we refer to as equity principles. But, the United States was never very excited about this agreement and began ignoring its responsibility since the Convention began in 1994. George Bush Sr. best expressed this attitude when he said, “the American way of life is not up for negotiation”.

When negotiations began for the Paris Climate Agreement in 2015, even Obama’s special climate diplomat, Todd Stern, was also very clear — he said, “if equity is in, we’re out”. Thus, while the Agreement does mention equity, it lacks a clear system to determine what is fair and equitable between rich and poor countries — instead leaving each to decide on their own. The result in terms of climate is that we’re on track for 3–4 degrees Celsius of more warming.

Summary:

## What Could Equity in Climate Action Look Like?

It is possible to determine what a fair assignment of responsibility would be. A broad coalition has developed a “fair shares” methodology based on equity principles. There is a [helpful online calculator](#) developed by the Climate Equity Reference Project, which allows the user to measure each country’s historical responsibility as well as their capacity to reduce the emissions it will put into the atmosphere from now on. This is done by considering incomes across the population; incomes of people who can only cover basic needs are not counted, so this accounts for a large part of the populations in poor countries.

When you run the numbers it quickly becomes apparent that a fair assignment of emissions reductions globally requires high-income countries to 1) reduce their emissions to as near as possible to real zero as quickly as possible, and 2) to simultaneously make it possible for poor countries to avoid emissions while they develop (e.g. build renewable energy systems, hospitals, schools, environmentally friendly industries etc.).

When we talk about equity, we're talking about the right to a dignified life. A right to food, water, land, energy, decent work in decent conditions. These are basic rights. If we're not insistent on an equitable approach to climate action, we are essentially telling millions of people that their lives don't matter as much as our lifestyles.

Greta puts it even more clearly when she condemned a system in which "the suffering of the many pays for the luxury of the few."

Summary:

Adapted From: <https://www.climatechangenews.com/2019/10/02/greta-thunbergs-call-equity-mean/>