

How do the environment and genetics affect who we are and how we are similar or different?

Introduction

Over the course of this unit, students will be designing and writing a children's book with the theme of variation and heredity. They will create their own characters, setting, and plot, and describe a character's adventures as the character goes through life, struggles to survive, has offspring, and is influenced by their environment. In this task, students will first listen to you read a children's book to help them think about how stories are written to engage the reader. Students will discuss the plot, the characters, and the illustrations through the lens of a reader and a writer. The goal of this part of this task is to encourage students to start to imagine details in their story.

The second part of this task introduces students to science concepts that are woven through this unit. More specifically, students are introduced to the concepts about what a trait is, how traits vary from individual to individual, and how traits are inherited or are a result of environmental influences. Students will identify their own traits and compare their findings with those of their classmates. Students will discuss the variation of traits as being inherited or due to environmental changes. Finally, students will use evidence from their class data to take a stand on whether humans are more similar to each other or different from each other.

Objectives

Students will be able to

Content

- Identify human traits.
- Identify the influence of genetic and environmental factors on human traits.

Science and Engineering Practices

• Make an argument from evidence about whether humans are more similar to each other or more different from each other.

Equity and Groupwork

• Collaborate with teammates to identify human traits.

Language

• Identify the plot, theme, setting, characters, and engaging characteristics of a children's book.



cause

effect

gather

typical

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Language of Instruction

Academic Vocabulary

- characteristic
- dominant
- environment
- gene
- heredity
- inheritance, inherited
- plot
- recessive
- theme
- trait
- variation

Timing

This task can be completed in 3 class periods (based on 45-minute periods).

- Part I Example of an Engaging Story with a Message (1 class period)
- Part II Identify Human Traits (1 class period)
- Part III Connect to the Culminating Project and Assessment (0.5–1 class period)

Teacher Materials

- "A Storied Life and Human Traits" digital slide presentation
- Children's book; recommendations:
 - Elmer the Patchwork Elephant by David McKee (addresses the idea that being different is okay)
 - The Day Jimmy's Boa Ate the Wash by Trinka Hakes Noble
 - If You Give a Mouse a Cookie (or any of the others in this series) by Laura Numeroff
 - Because I Stubbed My Toe by Shawn Byous
 - The Lorax by Dr. Seuss (long version)
 - Where Once There Was a Wood by Denise Fleming
 - Cleaning Day by D. H. Figueredo
 - First Day in Grapes by L. King Perez

Background Knowledge

Genetics is an interesting and intriguing subject for most students. Students typically become curious about inheritance, genetics, and traits because these concepts directly relate to students' lives. They often have interesting, thoughtful, and scientific questions that lead to engaging discussions. Included in this background are some details about the science of genetics.

Human Traits

Human traits can be defined by:

- 1. Dominant or recessive genes (Mendelian genetics)
- 2. Codominant, incomplete dominant, sex-linked, sex-influenced, and multiple-allele genetics
- 3. The environment

Dominant Versus Recessive Genes (Mendelian Genetics)

Some genes are dominant, while other genes are recessive. The recessive gene is most often a mutation of the dominant gene and is usually seen less often. For example, in white flowers, the recessive gene is white, which means the flower has a recessive gene that missing the red protein, resulting in a white flower. In skin color, an albino gene is a mutation in the gene that produces melanin, the protein that colors skin. If the melanin gene is mutated, the person cannot make melanin, resulting in completely white skin. Note: Skin color is actually a situation in which the color is determined by multiple genes, so it is a trait that is more complex than just dominant and recessive.

Human Traits	Dominant/Recessive Facts
Earlobes	The dominant trait is free-hanging earlobes, sometimes called detached earlobes. The recessive trait is lobes that are attached directly to the head, sometimes called attached earlobes.
Tongue Rolling	The dominant trait is the ability to roll your tongue. The recessive trait is not being able to roll your tongue. The recessive trait is a mutation in a gene coding for a muscle that helps the tongue roll.
Widow's Peak	A widow's peak is dominant. A straight hairline is recessive.
Mid-Digit Hair	Hairy mid-digits is the dominant trait. The absence of hair on the mid-digits is the recessive trait. Hairy mid-digits is when there is hair on one or more of the mid-digits between the knuckles.)
Hitchhiker's Thumb	No hitchhiker's thumb, or a straight thumb, is dominant. Hitchhiker's thumb, or a curved thumb, is recessive.
Dimples	Dimples are dominant. They are best seen when smiling. There may be a dimple only on one side, or on both sides. The recessive trait is having no dimples.
Hand Clasping	The dominant trait is placing the left thumb on top of the right thumb when the hands are clasped (without thinking about it). The recessive trait is right thumb over left.
Cleft Chin	A prominent cleft is dominant. Females appear to be less conspicuously affected than males. No cleft is recessive.
Face Freckles	Face freckles are dominant. No face freckles is the recessive trait.
Handedness	Right-handedness is the dominant trait. However, scientists think that the recessive form of the gene does not cause left-handedness, but rather results in no dominance for either; thus, the handedness becomes a 50–50 chance.



Eye Color	Eye color (as well as hair and skin color) is a complex trait. The main pigment that colors the eyes is melanin—the more melanin, the darker the color. Eye color is controlled by more than one allele, which is why there is such a variation in this trait. Essentially, blue is recessive compared to green, and brown is dominant. Hazel eyes don't really change color, they simply reflect the colors being worn that day.
Hair Color	Hair color (as well as eye and skin color) is a complex trait. The main pigment that colors hair is melanin—the more melanin, the darker the color. Hair color is controlled by more than one allele, which is why there is such a variation in this trait. Essentially, blonde hair is recessive compared to red and brown, and black is dominant.



Codominant, Incomplete Dominant, Sex-Linked, Sex-Influenced, and Multiple-Allele Genetics (Non-Mendelian Genetics)

The following are genetic situations that Gregor Mendel did not discover—they were discovered later. This information exemplifies the complexity of genetics. Most traits do not fit into the simple dominance and recessive category, and for sixth graders all these different situations can be overwhelming. Thus, this information is intended just to be background knowledge for you and to help guide you if questions are brought up and further investigation is warranted.

Non-Mendelian Genetic Situation	Definition	Example
Codominance	Codominance is a genetic condition in which neither allele in the heterozygote is dominant or recessive. When an individual has both alleles in a gene pair in a heterozygote, both alleles are expressed, and the offspring has both traits.	 When a cow has both the brown and white allele and is spotted brown and white When a human has both the A and B blood type allele and has AB blood type
Incomplete Dominance	Incomplete dominance is a genetic condition in which both alleles are expressed, but the resulting phenotype is an intermediate trait between the two allele traits.	 When a rabbit has an allele for black and an allele for white, and the resulting phenotype is grey
Sex-Linked	Sex-linked traits are based on a genetic condition in which the gene is found on the sex chromosome.	 The following genes are found on the X chromosome: Color blindness Hemophilia Duchenne muscular dystrophy
Sex-Influenced	Sex-influenced traits are based on a genetic condition in which the gene is influenced by female or male hormones.	Baldness is influenced by testosterone. As a result, baldness is a dominant trait in males and a recessive trait in females.
Multiple-Allele	Multiple-allele traits are based on a genetic condition in which there are more than two alleles for the two allele positions.	Blood type has three alleles for two allele positions. Blood type has the A, B, and O allele, but each individual only has two alleles—for example, AB, AO, BB.

The following information is not meant to be taught in sixth grade.



Part I • Example of an Engaging Story with a Message

Introduce the Group Culminating Project

- 1. Introduce the group Culminating Project.
- 2. Read the introduction to the Culminating Project aloud, emphasizing the goal of teaching the reader about heredity and the interaction between traits and the environment.
- 3. See the Culminating Project section in the Unit Overview of the Teacher Edition for more details about this project.

Example of an Engaging Story with a Message

- 4. Introduce the children's book you are going to read to the class. (See Materials for recommended book options.)
- 5. Ask student volunteers to read the questions in the Student Edition.
- 6. Discuss and give examples of theme, plot, and cause and effect. Use Slides 2, 3, and 4 of the "A Storied Life and Human Traits" digital slide presentation.
- 7. Read the children's book.
- 8. Have students work in small groups to answer the questions in the Student Edition.
- 9. Discuss the questions as a class. During your discussion, start incorporating these words and ideas:
 - Traits of characters.
 - Variation of traits in characters
 - Why characters have certain traits, which leads to discussions around the crosscutting theme in this unit, cause and effect

Answers to Questions

- What big ideas, themes, or messages do you think the author wants you to understand?
 - The answer depends on the book read.
 - Ask students to remind you what a theme is.
 - Remind students what the theme of their book for the Culminating Project will be. The theme is on the introduction to the culminating project page. The theme is heredity (showing that traits are passed from parents to offspring and environmental influences on traits).
- What are the different parts of the story: setting, characters, and plot?
 - Ask students what the setting is for this book. Have a student expand on another student's description.
 - Ask students to describe the characters in the book.
 - Create a model storyboard. Have students list the events in the story, and record their ideas on a board or chart paper. As students start voicing the events in the book, ask where they go in relation to (before/after) the other events that they mentioned. Start to place the events in order on your board or chart paper to create a sample storyboard as a model for students.
- What are some examples of cause and effect in the story?
 - Discuss the concept of cause and effect. Discuss some examples of cause and effect found in the story. Add the cause and effect examples to the model storyboard.
 - The answer to this question depends on the book that you read to the class.



- What is on a typical page of the book that makes the story fun and interesting?
 - A few words on a page
 - Interesting pictures that show the characters, the setting, and what is happening (e.g., events and problems)
 - A page number
 - And more...

Part II • Identify Human Traits

- 1. Review Slides 5–7 to introduce the concepts of human traits (characteristics), inherited traits, and genes. These will be important throughout the unit.
- Have students identify their own traits using the table in the Student Edition. Work through this part of the task
 with students using Slides 8–19 of the digital slide presentation in order to help students identify the traits
 correctly and answer any student questions for each trait. Encourage students to work together to help each other
 identify traits.
- 3. Students should circle the picture of their own traits as you walk them through these traits on the slides.
- 4. Go back through the traits and poll the class for each trait.
- 5. Students should fill in the class data columns with the number of students having each trait.
- 6. Give students a few minutes to discuss question 3 from their Student Edition and write out their answer in their science notebook.
- 7. Lead a class discussion addressing question 3, and any questions students bring up about the tasks and the concepts of heredity and environmental influences. The chart below gives some examples of genetic traits versus traits that are due to environmental influences. Note: This discussion might be long and may go in many directions due to student curiosity.

Human Traits	Genetic Traits (can pass on to offspring)	Traits Based on Environmental Influences (can NOT pass on to offspring)
Eyes	Two eyes, distance between eyes, size of eyes, color of eyes	Wearing contacts to change color of eye
Skin	White, brown, black, etc.	Changing from white to dark brown (getting a tan from the sun or tanning booth), getting a sunburn
Muscles	Have muscles to move	Large muscles from working out Strong muscles from working out
Hair	Has hair, straight, curly, wavy, brown, blonde, black	Straight to curly with a perm or curling iron Curly to straight with a flat iron Change color with dyes
Height	Short, medium, tall, very tall, grow at a young age, grow when you are older	If you do not get enough food (nutrition) you may become shorter
Hearing Seeing	Being able to hear with your ears and see with your eyes	Illness/cancer may damage your inner ear and cause deafness; damage to eyes can cause blindness



LANGUAGE SUPPORT STRATEGIES

- Some common pitfalls with argumentation are that only a few students contribute, students become upset when others disagree with them, students do not back up their claim with evidence, etc. In order to avoid these pitfalls, try these suggestions: conduct partner shares or small-group discussions before whole-class talk in order to garner more equitable student participation; provide sentence stems for respectful disagreement, such as "While I agree that _____, I also think _____"; provide sentence stems to encourage students to use evidence, such as "This was shown by the data because _____."
- 8. Have students fill in the Claim, Evidence, Reasoning chart in order to answer the question: Are humans more similar to each other or more different from each other? Different students might answer this question differently. Both answers can be argued correctly depending on the evidence that students use. Students may reason that humans are different due to genetics or the environment, and that they are similar due to genetics or the environment. For this reason, the discussion may be lively, lead to many questions and answers, and in the end leave students with questions they must ponder throughout the unit. Some students may struggle with filling in this type of chart; if so, model both sides of the claim with one of the examples from the chart below. Use the sentence stems provided to show students how to proceed if they get stuck with the language.

Similar to Each Other	Different from Each Other
Two legs	Length of legs, shape of legs
Two eyes	Color of eyes
Two ears	Shape of ears
Hair	Color of hair, texture of hair, thickness of hair



LANGUAGE SUPPORT: SENTENCE FRAMES

Use these sentence stems for students who need help with the Claim, Evidence, and Reasoning chart.

Claim:

Humans are more ______ because ______.

Evidence:

One piece of evidence to back up this claim is _____

For example, when the class was polled about different traits, we found that ______.

Reasoning:

These traits can be explained by _____. In the scientific community, it is believed that _____.

A Storied Life and Human Traits



9. At the end of the task, ask students to reflect on what they have learned over the course of this task by answering the following question in their Student Edition: How has your idea of what a trait is changed over the course of this task? In particular, do you still have the same ideas about where traits come from?

There is no right answer, but encourage students to think about their ideas from the beginning of the class about what traits are and what they have now added to or changed about their ideas.

Part III • Connect to the Culminating Project and Assessment

- 1. Have students independently complete the Lift-Off Task portion of the Individual Project Organizer in class.
- 2. Collect the Individual Project Organizers and assess using a criterion of your choice.
- 3. Return the Individual Project Organizers. Give students time to make revisions based on one of these two options.
 - Have students make changes to their Individual Project Organizer according to your comments. (This could be done for homework, depending upon students' needs and/or class scheduling.)
 - Ask students to exchange their Individual Project Organizer with a partner, and give partners 5 minutes to provide written feedback. Then allow students time to make changes to their work according to the feedback.