Three-Dimensional Task Modification Sample

Blue People of Kentucky

Grade Level:
Biology

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.

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Three-Dimensional Task Modification Sample Components

The development of three-dimensional tasks for science is a long and complex process. As such, teachers will likely use tasks that come with adapted materials or that they find elsewhere. Session A of the science professional learning module *Three-Dimensional Tasks* provides participants with experience in utilizing tools to screen science tasks to help ensure they meet the intent of the learning.

This high school sample demonstrates how the science task screener can be used to inform the modification of an existing task. This sample consists of these four components:

- The original task
- The task screener used to inform the modifications made
- The rationale for changes made to the task
- The modified task with intended purpose and alignment

Alignment, in this case, refers to the specific elements of each of the dimensions. Not every question will provide evidence of every dimension or the complete element of a dimension. The components that are bolded identifies the intended alignment.

Sample:

Question	Disciplinary Core Idea	Science and Engineering Practice	Crosscutting Concept
(question number)	**LS3.A: Inheritance of Traits** **Variations of inherited traits between parent and offspring arise from genetic differences** that result from the subset of chromosomes (and therefore genes) inherited.	**Asking Questions and Defining Problems** **Ask questions that arise from** careful observation of phenomena, **models**, or unexpected results, **to** clarify and/or **seek additional information.**	

In the sample above, a hypothetical question is intended to determine student understanding of the core idea in conjunction with the practice of asking questions. However, no crosscutting concept is being assessed. In addition, only certain components of the elements within these two dimensions are targeted; not the entire element.

It's important to note that this is only a sample of how an existing task may be modified using information from the task screener and does not imply that the modified task is an exemplar.

Original Task

Blue People of Kentucky

Assessment Task- Blue People of Kentucky Inheritance Pattern

Fugates of Kentucky: Skin Bluer than Lake Louise

Genetics and in-breeding cause six generations of a family to turn blue.

BySusan Donaldson James

February 21, 2012, 3:02 PM

Benjamin "Benjy" Stacy so frightened maternity doctors with the color of his skin -- "as Blue as Lake Louise" -- that he was rushed just hours after his birth in 1975 to University of Kentucky Medical Center. As a transfusion was being readied, the baby's grandmother suggested to doctors that he looked like the "blue Fugates of Troublesome Creek." Relatives described the boy's great-grandmother Luna Fugate as "blue all over," and "the bluest woman I ever saw." In an unusual story that involves both genetics and geography, an entire family from isolated Appalachia was tinged blue. Their ancestral line began six generations earlier with a French orphan, Martin Fugate, who settled in Eastern Kentucky. Doctors don't see much of the rare blood disorder today, because mountain people have dispersed and the family gene pool is much more diverse. But the Fugates' story still offers a window into a medical mystery that was solved through modern genetics and the sleuth-like energy of Dr. Madison Cawein III, a hematologist at the University of Kentucky's Lexington Medical Clinic. Cawein died in 1985, but his family charts and blood samples led to a sharper understanding of the recessive diseases that only surface if both parents carry a defective gene.The most detailed account, "Blue People of Troublesome Creek," was published in 1982 by the University of Indiana's Cathy Trost, who described Benjy's skin as "almost purple."

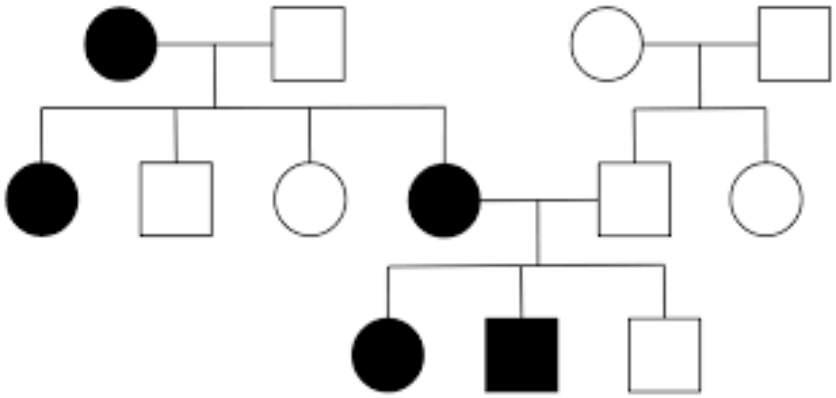
The Fugate progeny had a genetic condition called methemoglobinemia. "It's a fascinating story," said Dr. Ayalew Tefferi, a hematologist from Minnesota's Mayo Clinic. "It also exemplifies the intersection between disease and society, and the danger of misinformation and stigmatization." Methemoglobinemia is a blood disorder in which an abnormal amount of methemoglobin -- a form of hemoglobin -- is produced, according to the National Institutes for Health. Hemoglobin is responsible for distributing oxygen to the body and without oxygen, the heart, brain and muscles can die.

(https://abcnews.go.com/Health/blue-skinned-people-kentucky-reveal-todays-genetic-lesson/story?id=15759819)

Explore/Explain:

Examine the pedigree of the Blue People below and answer the following questions:

1. Make at least three observations regarding the pedigree.
2. Describe what is meant by the symbols (circles vs squares, colors, connecting lines, etc)
3. Predict if the genetic condition is inherited as either dominant or recessive and support your prediction with evidence from the pedigree.
4. Create a Punnett Square to show the inheritance pattern of the trait. Provide evidence from your Punnett Square to support your prediction from above.
5. If you would have known more generations would you have been better able to interpret the pedigree? Why or why not?



https://commons.wikimedia.org/wiki/File:Wiki_Drawing_-_Autosomal_Dominant_%281%29.svg

Performance

The condition of Methemoglobinemia (being blue) is an inherited trait that results when errors occur during DNA replication and the genes responsible for producing the proteins necessary for normal blood are mutated.

1. Make and defend a claim using evidence to describe how errors can occur during DNA replication and how those errors can then result in a genetic disorder (such as methemoglobinemia -being blue).
2. The expression of traits are also affected by environmental factors that can lead to mutations. Choose one environmental factor that could affect trait expression and explain how this factor would result in genetic variations within the population.

Task Screener

Blue People of Kentucky

Science Task Screener

Introduction

The purpose of the Next Generation Science Standards (NGSS) Task Screener is **1)** to determine whether classroom assessment tasks are high quality, designed to elicit evidence of three-dimensional performances, and designed to support the purpose for which they will be used, and **2)** to provide a group of reviewers with a common set of features to ground conversations about what it "looks like" for students to demonstrate the kinds of performances expected by three-dimensional standards. This Screener builds off the criteria in Category III of the EQuIP Rubric for Science by more clearly specifying features for the assessment tasks embedded in lessons and units.

The directions for using the Task Screener assume an understanding of *A Framework for K–12 Science Education* and the NGSS, including how the NGSS are different from past standards as outlined in Appendix A of the NGSS and the Innovations of the NGSS. The Task Screener focuses on determining whether what is new and different about three-dimensional expectations are accurately represented in the tasks being evaluated. For more information about how the Task Screener was developed and fits into the EQuIP suite of tools, please see these Frequently Asked Questions.

Task Screener Overview

The Task Screener is organized around four criteria:

A. Tasks are driven by **high-quality scenarios that focus on phenomena or problems.**

B. Tasks require **sense-making using the three dimensions.**

C. Tasks are **fair and equitable.**

D. Tasks support their **intended targets and purpose.**

Each criterion includes:

1. A set of indicators to help reviewers determine whether the criterion is met.
2. A set of response forms for gathering and analyzing evidence, providing suggestions for improvement, and rating the task.

To use the Task Screener effectively, users should use the indicators and response forms to collect specific and detailed evidence from the task under review. Then, users should consider the body of evidence to determine how well each criterion is addressed within the task.

While it is possible for the Screener to be applied by an individual, the real power of the Task Screener lies in the meaningful conversations it can drive among a team of reviewers as part of a collaborative process. Just as when using other resources in the EQuIP suite of tools, collaborative teams of users should:

1. Individually record criterion-based evidence using the provided response forms;
2. Individually make suggestions for improvement; and then
3. Collaboratively discuss findings with team members before checking one of the boxes under the "Evidence of Quality?" section included at the end of the screening process. As part of these discussions, reviewers should address any differences in how they interpreted the criteria and indicator language, as well as the evidence they found, to support a common understanding of the task, the expectations outlined in the screener, and how well the task met those expectations. A rating of "Adequate" means that the task meets the criterion. If the collaborative feedback is being used to improve the task or make decisions about how it should be used, use a blank set of response sheets to capture the consensus feedback.

Science Task Screener

Using the Task Screener. Use this tool to evaluate tasks designed for three-dimensional standards. For each criterion, record your evidence for the presence or absence of the associated indicators. After you have decided to what degree the indicators are present within the task, revisit the purpose of your task and decide whether the evidence supports using it.

Before you begin: Complete the task as a student would. Then, consider any support materials provided to teachers or students, such as contextual information about the task and answer keys/scoring guidance.

A. Tasks are driven by high quality scenarios that are grounded in phenomena or problems.	B. Tasks require sense making using the three dimensions.
i. Making sense of a phenomenon or addressing a problem is necessary to accomplish the task.	i. Completing the task requires students to use reasoning to sense-make about phenomena or problems.
ii. The task scenario—grounded in the phenomena and problems being addressed—is sufficient, engaging, relevant, and accessible to a wide range of students.	ii. The task requires students to demonstrate grade-appropriate: a. SEP element(s) b. CCC element(s) c. DCI element(s)
	iii. The task requires students to integrate multiple dimensions in service of sense-making and problem-solving.
	iv. The task requires students to make their thinking visible.

C. Tasks are fair and equitable.	D. Tasks support their intended targets and purpose.
i. The task provides ways for students to make connections of meaningful local, global, or universal relevance. ii. The task includes multiple modes for students to respond to the task. iii. The task is accessible, appropriate, and cognitively demanding for all learners, including students who are English learners or are working below or above grade level. iv. The task cultivates or explicitly builds upon students' interest in and confidence with science and engineering. v. The task focuses on performances for which students' learning experiences have prepared them (opportunity to learn considerations). vi. The task uses information that is scientifically accurate.	i. The task assesses what it is intended to assess, and supports the purpose for which it is intended. ii. The task elicits student artifacts that provide evidence of how well students can use the targeted dimensions together to make sense of phenomena and design solutions to problems. iii. Supporting materials include clear answer keys, rubrics, and/or scoring guidelines that are connected to the targeted three-dimensional standards and provide the necessary and sufficient guidance for interpreting student responses relative to all three dimensions and the target as a whole. iv. The task's prompts and directions provide sufficient guidance for the teacher to administer it effectively and for the students to complete it successfully while maintaining high levels of students' analytical thinking as appropriate.

Blue people

Tasks designed for the NGSS include clear and compelling evidence that:	What was in the task, where was it, and why is this evidence?
i. Making sense of a phenomenon or addressing a problem is necessary to accomplish the task.	1) *Is a phenomenon and/or problem present?* yes 2) *Is information from the scenario necessary to respond successfully to the task?* Not really, the first part can be done just from looking at the diagram and the last part is not directly connected to the phenomenon as students can use any mutation in their answer
ii. The task scenario is engaging, relevant, and accessible to a wide range of students.	**Features of engaging, relevant, and accessible tasks (Check the appropriate box, then describe rationale with evidence)**

Scenario presents real-world observations	☑	☐	☐
Scenarios are based around at least one specific instance, not a topic or generally observed occurrence (e.g., observations related to a specific hurricane rather than "hurricanes" in general)	☑	☐	☐
Scenarios are presented as puzzling/intriguing	☑	☐	☐
Scenarios create a "need to know"	☑	☐	☐
Scenarios are explainable using grade-appropriate SEPs, CCCs, DCIs	☑	☐	☐

Scenarios effectively use at least 2 modalities (e.g., images, diagrams, video, simulations, textual descriptions)	☑	☐	☐
If data are used, scenarios present real/well-crafted data	☑	☐	☐
The local, global, or universal relevance of the scenario is made clear to students[1]	☑	☐	☐
Scenarios are comprehensible to a wide range of students at grade-level	☑	☐	☐
Scenarios use as many words as needed, no more	☑	☐	☐
Scenarios are sufficiently rich to drive the task	☑	☐	☐

Across all indicators, there is _____ evidence of quality of this criterion (choose one).

- ☐ No
- ☐ Inadequate
- ☑ Adequate
- ☐ Extensive

1. When considering whether the scenario creates a need to know for students, consider whether the scenario makes the uncertainty associated with explaining a phenomenon or solving a problem central, in ways that are likely to 1) connect with students' own experiences or knowledge, and 2) connect to disciplinary core ideas (regardless of whether those ideas are explicitly named or required by the task).

2. Consider whether an authentic stakeholder group is interested in the outcome of the scenario, and/or whether students are given enough information to answer the question "why should I care?".

Suggestions for improvement of the task for Criterion A:

Have the performance part about the phenomenon so they are ~~Continuing~~ continuing their efforts to understand why it could have happened.

Tasks designed for the NGSS include clear and compelling evidence that:	What was in the task, where was it, and why is this evidence?
i. Completing the task requires students to use reasoning to sense-make about phenomena or problems.	*Consider in what ways the task requires students to use reasoning to engage in sense-making and/or problem solving.* Yes, it does for the first part but then loses it a little in the performance part.
ii. The task requires students to demonstrate grade-appropriate: • SEP element(s) • CCC element(s) • DCI element(s)	Evidence of **SEPs** (which element [s], and how does the task require students to demonstrate this element in use?) Not sure if this is, argumentation or an explanation for performance one? Students will definitely be required to make + defend claim question? Evidence of **CCCs** (which element [s], and how does the task require students to demonstrate this element in use?) Cause + effect is present Evidence of **DCIs** (which element [s], and how does the task require students to demonstrate this element in use?) Yes
iii. The task requires students to integrate multiple dimensions in service of sense-making and/or problem-solving.	*Consider in what ways the task requires students to use multiple dimensions together to sense make and/or problem-solve.* They are trying to make sense of how genetic mutations can happen using their evidence to support the cause + effect.
iv. The task requires students to make their thinking visible.	*Consider in what ways the task explicitly prompts students to make their thinking visible. Look for evidence of how the task surfaces current understanding, abilities, gaps, and problematic ideas.* When students make claims + try to support it w/ evidence, it will be evident who understands + where your gaps are.

Across all indicators, there is _____ evidence of quality of this criterion (choose one).

- [ ] No
- [x] Inadequate
- [ ] Adequate
- [ ] Extensive

Suggestions for improvement of the task for Criterion B:

Have the perfamance part about the phenomenon so they are continuing their effort to understand why it could have happened.

Tasks designed for the NGSS include clear and compelling evidence of the following:	What was in the task, where was it, and why is this evidence?
i. The task provides ways for students to make connections of local, global, or universal relevance.	*Consider specific features of the task that enable students to make local, global, or universal connections to the phenomenon/problem and task at hand. Note: This criterion emphasizes ways for students to find meaning in the task; this does not mean "interest." Consider whether the task is a meaningful, valuable endeavor that has real world relevance—that some stakeholder group locally, globally, or universally would be invested in.* Yes, students are making sense of a real world phenomenon that happened in KY.
ii. The task includes multiple modes for students to respond to the task.	*Describe what modes (written, oral, video, simulation, direct observation, peer discussion, etc.) are expected/possible for student responses.* Written
iii. The task is accessible, appropriate, and cognitively demanding for all learners, including students who are English learners or are working below or above grade level.	*Consider how the task supports all learners, including:* Task includes appropriate scaffolds ☑ ☐ ☐ Tasks are coherent from a student perspective ☑ ☐ ☐ Tasks respect and advantage students' cultural and linguistic backgrounds ☑ ☐ ☐

3. For more information about culturally and linguistically responsive classroom assessments, please see this resource.

Tasks designed for the NGSS include clear and compelling evidence of the following:	What was in the task, where was it, and why is this evidence?
iii. (continued)	Yes / Somewhat / No / Rationale
	Tasks provide both low- and high-achieving students with an opportunity to show what they know ☑ ☐ ☐
	Tasks use accessible language ☑ ☐ ☐
iv. The task cultivates students' interest in and confidence with science and engineering.	Consider how the task cultivates students interest in and confidence with science and engineering, including opportunities for students to reflect their own ideas as a meaningful part of the task; make decisions about how to approach a task; engage in peer/self-reflection; and engage with tasks that matter to students. Somewhat, I think they would be interested in the "blue people" but I think the performance part would bse their interest as you steer away from the blue people.
v. The task focuses on performances for which students' learning experiences have prepared them (opportunity to learn considerations).	Consider the ways in which provided information about students' prior learning (e.g., instructional materials, storylines, assumed instructional experiences) enables or prevents students' engagement with the task and educator interpretation of student responses. It builds on previous instruction as students will have to be able to know what the symbols are in order to complete the first part. However, this will not interfere w/ the performance part

Tasks designed for the NGSS include clear and compelling evidence of the following:	What was in the task, where was it, and why is this evidence?
vi. The task presents information that is scientifically accurate.	*Describe evidence of scientific inaccuracies explicitly or implicitly promoted by the task.* None

Across all indicators, there is _____ evidence of quality of this criterion (choose one).

- ☐ No
- ☐ Inadequate
- ☑ Adequate
- ☐ Extensive

Suggestions for improvement of the task for Criterion C:

Before you begin:

1. **Describe what is being assessed. Include any targets provided, such as dimensions, elements, or PEs. :**

2. **What is the purpose of the assessment?** (check all that apply)

- [x] Formative (including peer and self-reflection)
- [ ] Summative
- [ ] Determining whether students learned what they just experienced
- [ ] Determining whether students can apply what they have learned to a similar but new context
- [ ] Determining whether students can generalize their learning to a different context
- [ ] Other (please specify) _____

Tasks designed for the NGSS include clear and compelling evidence that:	What was in the task, where was it, and why is this evidence?
i. The task assesses what it is intended to assess and supports the purpose for which it is intended.	*Consider in what ways:* 1 *The assessment target is necessary to respond to the task.* Yes 2) *Any ideas, practices, or experiences not targeted by the assessment are necessary to respond to the task. Consider the impact this has on students' ability to complete the task and interpretation of student responses.* No 3) *The student responses elicited support the purpose of the task (e.g., if a task is intended to help teachers determine if students understand the distinction between cause and correlation, does the task support this inference?).* Yes

Tasks designed for the NGSS include clear and compelling evidence that:	What was in the task, where was it, and why is this evidence?
ii. The task elicits artifacts from students as direct, observable evidence of how well students can use the targeted dimensions together to make sense of phenomena and design solutions to problems.	Consider what student artifacts are produced and how these provide students the opportunity to make visible their 1) sense-making processes, 2) thinking across all three dimensions, and 3) ability to use multiple dimensions together [note: these artifacts should connect back to the evidence described for Criterion B]. Yes, you will get this throughout as it scaffolds
iii. Supporting materials include clear answer keys, rubrics, and/or scoring guidelines that are connected to the three-dimensional target. They provide the necessary and sufficient guidance for interpreting student responses relative to the purpose of the assessment, all targeted dimensions, and the three-dimensional target.	Consider how well the materials support teachers and students in making sense of student responses and planning for follow up (grading, instructional moves), consistent with the purpose of and targets for the assessment. Consider in what ways rubrics include: 1) Guidance for interpreting student thinking, using an integrated approach, considering all three dimensions together as well as calling out specific supports for individual dimensions, if appropriate: All 3 dimensions will be evident throughout 2) Support for interpreting a range of student responses, including those that might reflect partial scientific understanding or mask/misrepresent students' actual science understanding (e.g., because of language barriers, lack of prompting or disconnect between the intent and student interpretation of the task, variety in communication approaches): I am used to 6th grade & know they may need more guidance in the type of evidence needed for the performance part but not sure if HS would need that. 3) Ways to connect student responses to prior experiences and future planned instruction by teachers and participation by students: If intent was to have them apply what was learned from the blue people to something new, could you rewind to have students pull from past experience? Either personal or something from the classroom? This also might help struggling students who "know" it but are just having a hard time coming up w/ their claim.

Tasks designed for the NGSS include clear and compelling evidence that:	What was in the task, where was it, and why is this evidence?
iv. The task's prompts and directions provide sufficient guidance for the teacher to administer it effectively and for the students to complete it successfully while maintaining high levels of students' analytical thinking as appropriate.	*Consider any confusing prompts or directions, and evidence for too much or too little scaffolding/supports for students (relative to the target of the assessment—e.g., a task is intended to elicit student understanding of a DCI, but their response is so heavily scripted that it prevents students from actually showing their ability to apply the DCI).* See answer from above

Across all indicators, there is _____ evidence of quality of this criterion.

- [ ] No
- [ ] Inadequate
- [x] Adequate
- [ ] Extensive

Suggestions for improvement of the task for Criterion D:

Consider the task purpose and the evidence you gathered for each criterion. Carefully consider the purpose and intended use of the task, your evidence, reasoning, and ratings to make a summary recommendation about using this task. While general guidance is provided below, it is important to remember that the intended use of the task plays a big role in determining whether the task is worth students' and teachers' time.

This could be used as is but w/ just a few easy changes I think it could help w/ some student frustration that might occur from some students.

Final recommendation

- [x] Use this task (all criteria had at least an "adequate" rating)
- [ ] Modify and use this task
- [ ] Do not use this task

Rationale for Modification

Blue People of Kentucky

Blue People Of Kentucky 3D Assessment Purpose Document

Purpose: **Purpose:** Formative task used in the middle of a larger unit of study investigating how the variations in characteristics among individuals within the same family may be passed from one generation to the next. Claims about inheritance patterns will be developed and supported with evidence and reasoning.

Task Modification Rationale:

The original Blue People of Kentucky Task started out with the initial opening reading telling the readers the exact inheritance mechanism for the genetic disorder. Many of the initial questions were removed to take away some of the confusion. The intention was to allow the students to understand that inheritance patterns present in the given pedigree and to make the connection back to the inheritance being a direct result of the DNA that was passed from parent to offspring.

After many recommendations and discussions the task focused more on the students making claims and supporting such claims using evidence. The opening article was cut down to not give away as much information and to allow the students to make predictions about how the behaviors and environments impact the traits that are inherited.

As this is a formative task, the purpose is to identify student understanding around key core ideas and their use of specific practices and crosscutting concepts. Students may work individually on questions 1, 2, and 4 while small groups of 3 or 4 could work together to complete the simulation on question 3. Students in the group could share their findings and discuss the patterns in their data before answering the task individually.

Modified Task and Alignment

Blue People of Kentucky

Assessment Task- Blue People of Kentucky Inheritance Pattern

Fugates of Kentucky: Skin Bluer than Lake Louise

Genetics and in-breeding cause six generations of a family to turn blue.

BySusan Donaldson James

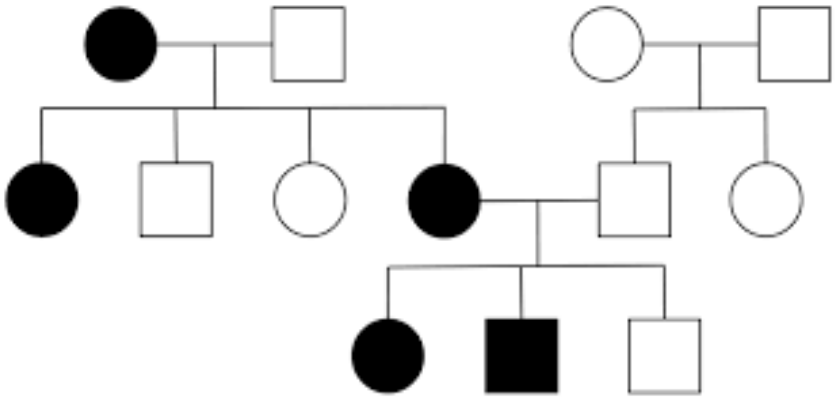
February 21, 2012, 3:02 PM

Benjamin "Benjy" Stacy so frightened maternity doctors with the color of his skin -- "as Blue as Lake Louise" -- that he was rushed just hours after his birth in 1975 to University of Kentucky Medical Center. As a transfusion was being readied, the baby's grandmother suggested to doctors that he looked like the "blue Fugates of Troublesome Creek." Relatives described the boy's great-grandmother Luna Fugate as "blue all over," and "the bluest woman I ever saw." In an unusual story that involves both genetics and geography, an entire family from isolated Appalachia was tinged blue. Their ancestral line began six generations earlier with a French orphan, Martin Fugate, who settled in Eastern Kentucky. Doctors don't see much of the rare blood disorder today, because mountain people have dispersed and the family gene pool is much more diverse. But the Fugates' story still offers a window into a medical mystery that was solved through modern genetics and the sleuth-like energy of Dr. Madison Cawein III, a hematologist at the University of Kentucky's Lexington Medical Clinic. Cawein died in 1985, but his family charts and blood samples led to a sharper understanding of the recessive diseases that only surface if both parents carry a defective gene.The most detailed account, "Blue People of Troublesome Creek," was published in 1982 by the University of Indiana's Cathy Trost, who described Benjy's skin as "almost purple."

(https://abcnews.go.com/Health/blue-skinned-people-kentucky-reveal-todays-genetic-lesson/story?id=15759819)

Examine the pedigree of the Blue People below and answer the following questions:

1. Make at least three observations regarding the pedigree.
2. Describe what is meant by the symbols (circles vs squares, colors, connecting lines, etc)
3. Predict if the genetic condition is inherited as either dominant or recessive and support your prediction with evidence from the pedigree.
4. Create a Punnett Square to show the inheritance pattern of the trait. Provide evidence from your Punnett Square to support your prediction from above.
5. If you would have known more generations would you have been better able to interpret the pedigree? Why or why not? Support your claim with evidence.



https://commons.wikimedia.org/wiki/File:Wiki_Drawing_-_Autosomal_Dominant_%281%29.svg

The condition of Methemoglobinemia (being blue) is an inherited trait that results when errors occur during DNA replication and the genes responsible for producing the proteins necessary for normal blood are mutated.

6. Make and defend a claim to describe the likely outcome if individual III-3 had a child with an individual who did not have blue skin but whose mother did in fact show the trait. Provide evidence to support your claim.
7. Create a Pedigree to show the likely inheritance for the individuals listed in question one. Assume that these individuals have three children. You need to include at least three generations in your pedigree.

Blue People of Kentucky 3D Assessment Rubric

Purpose: Formative task used in the middle of a larger unit of study investigating how the variations in characteristics among individuals within the same family may be passed from one generation to the next. Claims about inheritance patterns will be developed and supported with evidence and reasoning.

Supports understanding of:

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Question	Disciplinary Core Idea	Science and Engineering Practice	Crosscutting Concept
Question 1 and 2: Make at least three observations regarding the pedigree. Describe what is meant by the symbols (circles vs squares, colors, connecting lines, etc)	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;** some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	**Developing and Using Models** Develop, revise and/or **use a model based on evidence to illustrate** and/or predict **the relationships between systems or between components of a system.**	
Question 3: Predict if the genetic condition is inherited as either dominant or recessive and support	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule,	**Developing and Using Models** Develop, revise and/or **use a model based on evidence to illustrate**	**Cause and Effect** **Empirical evidence is required to differentiate between cause and correlation**

Question	Disciplinary Core Idea	Science and Engineering Practice	Crosscutting Concept
your prediction with evidence from the pedigree.	and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;** some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	and/or predict **the relationships between systems or between components of a system.**	and make claims about specific causes and effects
Question 4: Create a Punnett Square to show the inheritance pattern of the trait. Provide evidence from your Punnett Square to support your prediction from above.	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;** some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	**Developing and Using Models** **Develop** and/or use **multiple types of models to** provide mechanistic accounts and/or **predict phenomena** and move flexibly between model types based on merits and limitations.	

Question	Disciplinary Core Idea	Science and Engineering Practice	Crosscutting Concept
Question 5: If you would have known more generations would you have been better able to interpret the pedigree? Why or why not? Support your claim with evidence.	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;** some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	**Analyzing and Interpreting Data** **Consider limitations of data analysis (e.g., measurement, error, sample selection) when analyzing and interpreting data.**	**Cause and Effect** **Empirical evidence is required to differentiate between causes and correlation and make claims about specific causes and effects.**
Question 6: Make and defend a claim to describe the likely outcome if individual III-3 had a child with an individual who did not have blue skin but whose mother did in fact show the trait. Provide evidence to support your claim.	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;**	**Engaging in Argument From Evidence** **Make and defend a claim based on evidence about the natural world** or the effectiveness of a design solution **that reflects scientific knowledge**, and student- generated evidence	**Cause and Effect** **Empirical evidence is required to differentiate between causes and correlation and make claims about specific causes and effects.**

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	some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.		
Question 7: Create a Pedigree to show the likely inheritance for the individuals listed in question one. Assume that these individuals have three children. You need to include at least three generations in your pedigree.	**HS-LS3.A Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. **All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein;** some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	**Developing and Using Models** **Develop**, revise, and/or use **a model based on evidence to** illustrate and/or **predict the relationships between** systems or **components of a system.**	**Cause and Effect** **Cause and effect relationships can be suggested and predicted for complex natural** and human designed **systems** by examining what is known about smaller scale mechanisms within the system.