Insulin Storage and Shipping Container

PROBLEM

The Problem

Take a few minutes to watch a video about a child named Kai. He lives with diabetes. As you watch the video, write down some things you notice and wonder about.

Things I **noticed**...	Things I **wonder** about...

Design Challenge and Parameters

The video you watched showed how difficult it is to live with diabetes. One of the biggest challenges for people who have diabetes is keeping enough insulin on hand to treat the disease. Storing insulin is difficult for patients because insulin must be kept cool or it will not work. Shipping insulin is also difficult because keeping insulin cool inside a package is expensive and generates a lot of waste. Your goal in this design challenge is to create a container that people can use to store and ship insulin.

The container must be able to a 10 ml vial of insulin at a temperature between 10˚C and 25˚C for at least 24 hours regardless of how hot or cold it is outside the container. The container cannot use electricity to keep the insulin cool. The container must take up less than 6000 cm^3 of space and weigh less than 500 grams (17.6 oz), so it is easy for patients to carry it around in a bag and inexpensive for pharmaceutical companies to ship. Your client insists that anyone who uses the container must be able to remove or replace a vial that holds insulin quickly (under 3 seconds) when they open it. They would also like the container to hold at least f4 vials of insulin and 12 syringes, but they would like it to hold more of each item if possible. Your client also wants the container to be completely reusable so patients can use it to store their insulin and then send it back to the supplier when they run out. The supplier can then put new vials of insulin in the container and send it back to the patient without generating any waste. Your client insists that the container must cost less $12.00 to make.

ARGUMENT-DRIVEN INQUIRY

Insulin Storage and Shipping Container

PROBLEM

Take a few minutes to identify the design constraints and criteria for the storage and shipping container by filling out the chart below. Design constraints are requirements that are set by someone that limit what can or cannot be done and design criteria are requirements that provide a direction for improvement and a way to compare designs.

Design **constraints**...	Design **criteria**...

Initial Ideas

Take a few minutes to think about the different ways you keep liquids cold before you start this design challenge. List some things you know about how to keep thing cold and some things that you think you will need to learn more about in the boxes below.

Some **ideas** I have...	Some things I need to **learn** about...

ARGUMENT-DRIVEN INQUIRY

Insulin Storage and Shipping Container

IDEAS

Some Ideas You Can Use: Insulin and Diabetes
Diabetes is a chronic disease that occurs when the pancreas is no longer able to make insulin or when the body cannot make good use of the insulin that it is produced by the pancreas. **Insulin** is a hormone that helps glucose get into the cells. Not being able to produce insulin or use it effectively leads to raised glucose levels in the blood. Take a minute to watch a quick video about insulin and blood sugar regulation.

People with diabetes need to be able to take insulin any time their blood sugar level increases above a safe level. People with diabetes therefore need a way to keep insulin with them at all times. However, insulin must be kept at a temperature between 10˚C and 25˚C or it will break down and not work when it is injected. People who use insulin to manage their blood sugar level therefore need to be able to keep their insulin cool when they away from home.

Pharmaceutical companies that make insulin often ship vials of insulin directly to people who have diabetes. To keep the insulin cool while it is in transit, it is often pack in large disposable packages with ice packs. The picture at right shows an example of a package that was used to ship insulin to a patient. The box, filling, and the ice packs are usually discarded by the patient once the insulin arrives, which generates a lot of waste.

Some things I **know** from what I read…

Insulin Storage and Shipping Container

IDEAS

Some Ideas You Can Use: Thermal Energy and Energy Transfer

All matter is made of particles (atoms or molecules) that are constantly in motion. This means all the particles in an object have kinetic energy. The **thermal energy** of an object is the total amount of kinetic energy of all the particles that make up that object**. Temperature**, in contrast, is the average kinetic energy of all the particles in an object. The relationship between the temperature of an object and the total thermal energy of object depends on the type, state, and amount of matter present in the object. However, when an object increases in temperature, it means the kinetic energy of the particles that make up that objects has increased.

Thermal energy can move from one object to another. When you touch hot water, thermal energy moves from the water to your hand. When you touch cold water, thermal energy moves from your hand to the water. Thermal energy always moves from an object at a higher temperature to an object at a lower temperature. For example, when you put a 45°C piece of metal in a cup of 23°C water, thermal energy does not move from the water to the metal. Instead, thermal energy moves from the metal to the water because the piece of metal is at a higher temperature than the water. The temperature of the water then increases because it gains thermal energy from the piece of metal. When those objects reach the same temperature, they are in **thermal equilibrium**. When the objects are at the same temperature there is no net transfer of thermal energy.

Some things I **know** from what I read…

Insulin Storage and Shipping Container

IDEAS

Some Ideas You Can Use: Systems and Materials

Engineers often think of the products that they create for clients as a system. A **system** is a group of interacting or interdependent components or pieces of a whole. A storage and shipping container for insulin is an example of a system because it includes several interacting components, such as walls, a lid, and what will be stored inside of it. Engineers often describe a system in terms of inputs and outputs or processes and interactions. Engineers describe everything outside of a system as the **surroundings**. For example, the air outside of a storage and shipping container is often described as the surroundings of the storage and shipping container system.

It is important to think about how thermal energy will transfer into a system from the surroundings, between the components of a system, and out of a system and into the surroundings when attempting to make a storage container. Engineers must therefore consider what types of materials they use to build a storage and shipping container and how these materials affect the transfer of thermal energy over time. One important factor that affects how quickly thermal energy transfers into, within, or out of a storage container is the thermal conductivity of the materials that make up that system. **Thermal conductivity** is a measure of the ability of a material to transfer thermal energy. Materials with high thermal conductivity are called thermal **conductors**. Conductors transfer thermal energy quickly. Materials with low thermal conductivity are called thermal **insulators**. Insulators transfer thermal energy slowly.

Some things I **know** from what I read…

ARGUMENT-DRIVEN INQUIRY

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IDEAS

Some Materials and Tools You Can Use

You may use any of the following items to create an insulin storage and shipping container. Take a minute to examine all of them.

Material	Unit	Cost
Reusable Plastic Ice Cube	1 cube	$0.50
Reusable Cold Pack	1 pack	$2.67
1/8 Inch Thick Carboard	10 in x 10 in	$1.10
Aluminum Foil Sheet	12 in x 11 in	$0.04
Card Stock	8.5 in x 11 in	$0.06
Fabric Batting	36 in x 18 in	$5.00
1/2 Inch Foam Padding	36 in x 18 in	$3.66
1/2 Inch Pink Insulation Foam	12 in x 12 in	$3.75
Duct Tape	2 in x 36 in	$0.20
Hot Glue Stick	1 stick	$0.25

You will also be able to use the following tools:

- Cloth measuring tape
- Temperature probe
- Scale
- Hot glue gun
- Scissors
- Box cutter
- 10 ml vials
- 1 ml syringes (without needle)

Some things I want to **keep in mind** about these materials and tools…

Insulin Storage and Shipping Container

GENERATE

Generate A Concept

Create a design concept for the container and a model that explains how the design works. Be sure to include any unseen entities, such as energy or forces, in your model. You can use callouts to show things that are too small to see (such as atoms) and arrows to represent movement or forces. You can also draw pictures to show the designs works before, during, and after an event to help show change over time.

Concept

Estimated Budget

Material	Amount	Cost
	Total:	

Model

Before

During

After

Insulin Storage and Shipping Container

GENERATE

Generate A Second Concept

Create a second design concept for the container and a model that explains how the design works. Be sure to include any unseen entities, such as energy or forces, in your model. You can use callouts to show things that are too small to see (such as atoms) and arrows to represent movement or forces. You can also draw pictures to show the designs works before, during, and after an event to help show change over time.

Concept

Estimated Budget

Material	Amount	Cost
	Total:	

Model

Before

During

After

Insulin Storage and Shipping Container

GENERATE

Generate A Third Concept

Create a third design concept for the container and a model that explains how the design works. Be sure to include any unseen entities, such as energy or forces, in your model. You can use callouts to show things that are too small to see (such as atoms) and arrows to represent movement or forces. You can also draw pictures to show the designs works before, during, and after an event to help show change over time.

Concept

Estimated Budget

Material	Amount	Cost
	Total:	

Model

Before

During

After

Insulin Storage and Shipping Container

GENERATE

Evaluate the Concepts

The different concepts for the container that were generated by your group all have strengths and weaknesses. When engineers have to choose which concept to prototype, they must evaluate the potential **trade-offs** of each concept. The first step in this process is to determine if any of the concepts for the container violate a constraint. List any concepts that violate a constraint and the explain why.

Designs that Violate a Constraint	Reason

Now use the design criteria to create a decision matrix to figure out which concept to prototype. Once you have created your decision matrix, rate the concepts that did not violate a constraint relative to each other on each design criterion. Give the best concept a 1, the next best a 2, and so on. Once you are done rating the concepts, total the scores. The concept with the lowest overall score is the best overall design.

Criteria	Designs								
Total Score:									

ARGUMENT-DRIVEN INQUIRY.

Insulin Storage and Shipping Container

FEEDBACK

Concept to Prototype Argument

You will need to get some feedback from your classmates about the concept for the container you plan to protype before you start to build. To convince them that you are on the right track, develop an argument that answers the question:

Which concept are you going to prototype and why is it the best concept?

You will present your argument on a whiteboard (see below). It should include:

1. A **claim:** This is your answer to the question. It should include a model that shows the design and how you think it will work.

2. **Reasons**: Explain why your proposed design is the best option. Be sure to defend your design and choice of materials based on all the available information.

Question:	
Claim:	Reasons: • • • •

Argumentation Session

Share your argument with your classmates. Be sure to keep track of any ideas that you can use to revise your design and make it better in the space below.

Some possible ways to **improve** our design…

ARGUMENT-DRIVEN INQUIRY

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FEEDBACK

Modify the Concept you Plan to Prototype

Update the concept you will prototype based on the feedback you received from your classmates in the space. Be sure to update your model that explains how the design works as well. Once you are finished, share your plan with your teacher.

Design to Prototype

Updated Budget

Material	Amount	Cost
	Total:	

Model

Before

During

After

I approve of this plan.

Teacher's Signature

Date

Insulin Storage and Shipping Container

DO

Build and Test your Solution to the Problem

Use the available materials and tools to build a prototype of your design for the container. Be sure to keep track of how much of each material you use and any modifications you decide to make. Once you have created your prototype, test it to determine how well it performs on the different design criteria. Keep a record of what you measure or observe during your tests in the space below.

Insulin Storage and Shipping Container

DO

Refine and Test your Solution to the Problem

Refine your design based on the results of your tests. Be sure to keep track of any modifications you decide to make and how much of each type of material you use in the revised design. Once you have refined your prototype, test it to determine how well it performs on the different design criteria. Keep a record of what you measure or observe during your tests in the space below. Use the results of your tests to determine which aspects of the design to change and which aspects to keep the same.

Insulin Storage and Shipping Container

DO

Refine and Test your Solution to the Problem Again

Refine your design based on the results of your tests. Be sure to keep track of any modifications you decide to make and how much of each type of material you use in the revised design. Once you have refined your prototype, test it to determine how well it performs on the different design criteria. Keep a record of what you measure or observe during your tests in the space below. Use the results of your tests to determine which aspects of the design to change and which aspects to keep the same.

Insulin Storage and Shipping Container

SHARE

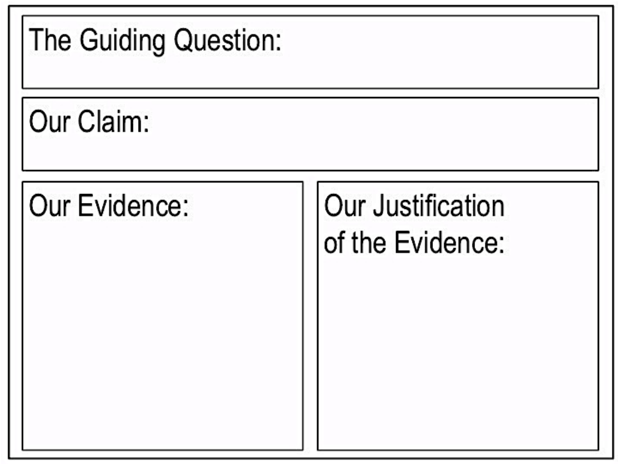
Quality of the Design Argument

Develop an argument that answers the question:

What is your solution to the problem of storing and shipping insulin?

You will present your argument on a whiteboard. It should include:

1. A **claim:** Your answer to the guiding question. Be sure to include a model that shows how your design works.
2. **Evidence**: An analysis of the data you collected and an interpretation of your analysis.
3. **Justification of the evidence:** Explain why your evidence matters. Be sure to include information about why you conducted the tests that you did and discuss any core ideas that you used.



Argumentation Session

Share your argument with your classmates. Be sure to keep track of any ideas that you can use to revise your argument and make it better in the space below.

Some possible ways to **improve** our argument…

Insulin Storage and Shipping Container

REFLECT

Reflective Discussion

You can keep track of any ideas from the discussion that you think are important or will be useful in the future in the space below.

Some important **ideas**…

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REPORT

Draft Report

Prepare a *report* to share your solution to the problem of storing and shipping insulin.

Introduction

______________________________ is a serious problem. Before we started this design challenge, we learned ______________________________

____

____

Our goal for this design challenge was to ______________________________

____

____

Our solution to this problem had to ______________________________

____

____

____

____

Method

We developed our ______________________________ by first

____

____

Next, we ______________________________

____

____

____

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____

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____

____

ARGUMENT-DRIVEN INQUIRY

Insulin Storage and Shipping Container

REPORT

Argument

Our solution to problem is ______________________

____

____

It works by ______________________

____

____

____

The table below shows ______________________

____

____

This analysis suggests ______________________

____

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____

____

This evidence is important because ______________________

____

____

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ARGUMENT-DRIVEN INQUIRY

Insulin Storage and Shipping Container

Design Challenge Information and Standards Alignment

Subject
Engineering

Discipline
Physical Science

Grade band
6-8

Task

Students design, construct, and test a container for storing and shipping insulin between 10°C and 35°C for at least 24 hours regardless of outside temperature. The container must minimize thermal energy transfer in order to keep the insulin cool.

Alignment with ASEE P-12 Engineering Learning framework

Teachers can use this investigation to help students reach any of the goals for engineering learning that are listed in the table below.

Dimension	Aspect	Expectation
Habits of Mind	Optimism	The ability to look at the more favorable side of an event or to expect the best outcomes in various situations.
	Persistence	The ability to follow through with a course of action despite of the challenges and oppositions one may encounter.
	Collaboration	The ability to work with others to complete a task and achieve desired goals, which includes effective communication.
	Creativity	The ability to think in a way that is different from the "norm" in order to develop original ideas.
	Conscientiousness	The ability to focus on performing one's duties well and with the awareness of the impact that their own behavior has on everything around them.
	Systems Thinking	The ability to recognize that all technological solutions are systems of interacting elements that are also embedded within larger human-made and/or natural systems and that each component of these systems are connected.
Practices	Engineering Design	Construct justified problem statements that highlight the key elements of a design scenario, including multiple perspectives, to guide the evaluation of trade-offs between multiple, and sometimes conflicting, goals, criteria, and constraints during a design project (Problem Framing).
		Collect, evaluate, and synthesize data and knowledge from a variety of sources to inform their design process (Information Gathering).
		Generate multiple innovative ideas through both divergent- and convergent thinking processes while communicating and recording ideas in two- and three-dimensional sketches using visual-spatial techniques (Ideation)
		Build a prototype of an idea using the appropriate tools and materials for the desired prototype fidelity level while establishing the appropriate testing/data collection procedures to improve their design (Prototyping)
		Make informed (data/evidence/logic driven) choices within a design scenario through the application of Engineering

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Design Challenge Information and Standards Alignment

		Knowledge and the use of decision-making tools to converge on one decision within a team setting (Decision-Making)
		Articulating their ideas, decisions, and information throughout and at the conclusion of a design project, with the consideration of the target audience through a variety of verbal and visual communication strategies and tools (Design Communication).
	Material Processing	Select the appropriate measurement devices and units and then applying them with precision to design, produce, and evaluate quality products (Measurement & Precision).
		Choose the appropriate tools, processes, techniques, equipment, and/or machinery to make a reliable, quality product/system based on a plan or workable approach to meet the specified design criteria of a customer in accordance with engineering standards (Fabrication).
		Distinguish between different materials in terms of their structures and properties and determine how to apply the materials to design/create quality products in a suitable and safe manner (Material Classification).
		Safely, responsibly, and efficiently process materials within a working environment without causing harm or injury to themselves or others (Safety)
	Quantitative Analysis	Select and implement the most appropriate method to collect and analyze quantitative data and then make, justify, and share a conclusion based on the analysis (Data Collection, Analysis & Communication).
	Professionalism	Make ethical decisions while engaged in an engineering project (Professional Ethics).
		Establish the appropriate work culture among team members in order to maintain honesty and integrity within an engineering project (Workplace Behavior/ Operations).
		Evaluate the interactions between engineering activities and society in order to create solutions to engineering problems that consider the voice, culture, needs, and desires of the people that the solution touches (Role of Society in Technological Development).
Knowledge	Engineering Sciences	Use thermodynamics content, such as (a) the Laws of Thermodynamics, (b) equilibrium, (c) gas properties, (d) power cycles and efficiency, and (e) heat exchangers, to analyze the forces within an energy system in order to solve problems in a manner that is analytical, predictive, repeatable, and practical.
		Use heat transfer content, such as (a) conductive, convective, and radiation heating and (b) heat transfer coefficients, to analyze how heat moves from one system (solid, liquid, or gas) to another in order to solve problems in a manner that is analytical, predictive, repeatable, and practical.
	Engineering Mathematics	Use geometric/trigonometric content and practices, such as (a) geometric measurement and dimensions, (b) expressing

		geometric properties with equations, (c) right triangles, (d) trigonometric functions, and (e) vector analysis, to solve problems in a manner that is analytical, predictive, repeatable, and practical.
	Engineering Technical Applications	Use environmental considerations content, such as (a) ground and surface water quality, (b) wastewater management, (c) air quality, and (d) environmental impact regulations and tests, in order to design methods to protect and manage our air, water, soil, and related ecosystems.

Alignment with Academic Standards for Science

Teachers can use this investigation to help students reach any of the performance expectations for science that are listed in the table below.

Source	**Code**	**Performance Expectation**
NGSS	MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
	MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Alabama	Grade 8 15	Analyze and interpret data from experiments to determine how various factors affect energy transfer as measured by temperature (e.g., comparing final water temperatures after different masses of ice melt in the same volume of water with the same initial temperature, observing the temperature change of samples of different materials with the same mass and the same material with different masses when adding a specific amount of energy).
Arizona	6.P1U1.1	Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases.
Florida	SC.7.P.11.1	Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state.

	SC.7.P.11.4	Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature.
Georgia	S8P2.d	Plan and carry out investigations on the effects of heat transfer on molecular motion as it relates to the collision of atoms (conduction), through space (radiation), or in currents in a liquid or a gas (convection).
Indiana	7.PS.8	Investigate a process in which energy is transferred from one form to another and provide evidence that the total amount of energy does not change during the transfer when the system is closed. (Law of conservation of energy).
	7.PS.9	Compare and contrast the three types of heat transfer: radiation, convection, and conduction.
Mississippi	PHS.8	Demonstrate an understanding of temperature scales, heat, and thermal energy transfer.
	PHS.8.3	Relate thermal energy transfer to real world applications of conduction, convection, and radiation.
	PHS.8.4	Use an engineering design process to construct a simulation of heat energy transfer between systems.
Missouri	6-8.PS3.A.3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
North Carolina	6.P.3.1	Illustrate the transfer of heat energy from warmer objects to cooler ones using examples of conduction, radiation and convection and the effects that may result.
Ohio	7.PS.3	Energy can be transformed or transferred but is never lost.
	7.PS.4	Energy can be transferred through a variety of ways.
Texas	8.9.A	investigate methods of thermal energy transfer, including conduction, convection, and radiation.
	8.9.B	Verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler until all the substances attain the same temperature such as an ice cube melting.
Utah	6.2.4	Design an object, tool, or process that minimizes or maximizes heat energy transfer. Identify criteria and constraints, develop a prototype for iterative testing, analyze data from testing, and propose modifications for optimizing the design solution. Emphasize demonstrating how the structure of differing materials allows them to function as either conductors or insulators.
Virginia	PS.6	Investigate and understand forms of energy and how energy is transferred and transformed.
	PS.7	Investigate and understand temperature scales, heat, and thermal energy transfer.
Wyoming	SES-MS-PS1-6.	Participate in a design project to keep thermal energy in a substance or container.

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Design Challenge Information and Standards Alignment

Alignment with Common Core State Standards for English Language Arts

Teachers can use this investigation to help students reach any of the performance expectations for reading, writing, or speaking and listening that are listed in the table below.

Strand	Code	Standard
Reading	RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
	RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
	RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.
	RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
	RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
	RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
	RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
	RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
	RST.6-8.10	Read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently
Writing	WHST.6-8.1.A	Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
	WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
	WHST.6-8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
	WHST.6-8.1.D	Establish and maintain a formal style.
	WHST.6-8.1.E	Provide a concluding statement or section that follows from or supports the argument presented.
	WHST.6-8.2.A	Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.

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Design Challenge Information and Standards Alignment

	WHST.6-8.2.B	Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
	WHST.6-8.2.C	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
	WHST.6-8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
	WHST.6-8.2.E	Establish and maintain a formal style and objective tone.
	WHST.6-8.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
	WHST.6-8.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
	WHST.6-8.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
	WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
	WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
	WHST.6-8.10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
Speaking and Listening	SL.6-8.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 6-8 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
	SL.6-8.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
	SL.6-8.1.B	Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
	SL.6-8.1.C	Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
	SL.6-8.1.D	Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make

		new connections in light of the evidence and reasoning presented.
	SL.6-8.3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
	SL.6-8.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
	SL.6-8.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
	SL.6-8.3	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Alignment with English Language Proficiency Standards

Teachers can use this investigation to help emerging multilingual students reach the performance expectations for English language proficiency listed in the table below.

Modality	**Code**	**Standard**
Receptive	ELP 1	Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing.
	ELP 8	Determine the meaning of words and phrases in oral presentations and literary and informational text.
Productive	ELP 3	Speak and write about grade-appropriate complex literary and informational texts and topics.
	ELP 4	Construct grade-appropriate oral and written claims and support them with reasoning and evidence.
	ELP 7	Adapt language choices to purpose, task, and audience when speaking and writing.
	ELP 9	Create clear and coherent grade-appropriate speech and text.
	ELP 10	Make accurate use of standard English to communicate in grade-appropriate speech and writing.
Interactive	ELP 2	Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.
	ELP 5	Conduct research and evaluate and communicate findings to answer questions or solve problems.
	ELP 6	Analyze and critique the arguments of others orally and in writing.