What do the primary causes of death in the US have to do with the dead zone in the Gulf of Mexico?

Grade level: Secondary

Timeframe: 6-weeks/2 hours per day

Introduction: The purpose of this curricular unit is to help students think critically, creatively, and strategically to address societal systems that currently contribute to personal, social, and environmental problems. When completed, students will have a greater understanding of interconnected systems and will have collaborated to identify viable solutions to interrelated problems. This unit fits into social studies and environmental science courses, and can also be utilized by government, economics, math, history, language arts, other science, and art and design courses. It can also be used in other formats (e.g., immersion summer courses, electives, after school programs, non-profit educational programs).

While it is structured over six weeks of two-hour daily classroom work, the unit can easily be adapted for a longer period to provide greater depth and breadth of learning. Although it is fairly detailed, we do not expect that you will follow it to the letter, and hope that you will make it your own so that it best meets your and your students’ goals and interests within the bounds of the solutionary lens and framework.
As you’ll notice, we’ve made some assumptions about the knowledge and skills high school students might already bring to this unit, as well as about the kinds of resources available. Please adapt this unit according to the needs and abilities of your students. For example, there may be requisite skills, knowledge, or interests that your students don’t yet have (e.g., data analysis, identifying main ideas, creating a math model, interviewing skills, specific critical thinking skills, connecting with the natural world); so you’ll want to customize and supplement accordingly.

Although there are elements required for a unit to be a truly solutionary unit, this unit is meant to be a guide, rather than a prescriptive mandate.

**Overview:**

What are the biggest killers of people in the U.S. today? What is the dead zone in the Gulf of Mexico? How can these two seemingly disparate problems possibly be connected? That’s what high school students will explore in this case study unit. Through hands-on, experiential learning, they will contribute ideas and solutions to both these problems while developing skills in:

- research, investigation, and assessing information for accuracy
- critical thinking, systems thinking, and design thinking
- problem solving and solutionary thinking
- written, verbal, and artistic communication
- reflection and mindfulness practices
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Enduring Understandings:

- Ecological and social systems are interconnected and affect people, nonhuman animals, and the environment.

- There are keystone systems that impact other systems (e.g., political/government systems that affect agriculture, corporate/advertising rights, and health care) and the keystone system(s) must be addressed for other systemic change to ultimately succeed.

- There are a range of strategies to influence keystone systems (e.g., educational campaigns, legislation, boycotts/buycotts, creating model systems like permaculture).

- Our choices (individual, school, community, national, global) affect ourselves, other people, nonhuman animals, and the earth.

- We are both individually and societally responsible for our choices, including what we eat. Food is the most influential daily choice we make with the biggest impact on our health, other beings, climate, habitat, water use, pollution, and more; we can choose a more sustainable and just diet personally and create systems to promote a more sustainable and just diet in our nation and beyond.

- Individuals have the power to make a positive difference; we can create solutions to our challenges.
Essential Questions:

**Overarching:**
- ★ How do political/government, food/industrial agriculture, media, corporate/industry, health care, and ecological systems interrelate and affect one another?
- ★ What are the impacts of political/government, food/industrial agriculture, media, corporate/industry, and health care systems on ourselves, other people, animals, and the earth?
- ★ How can we determine whether a system is healthy for all people, animals, and the environment?
- ★ What is the importance of a healthy ecosystem?
- ★ What is our responsibility for protecting ecosystems?
- ★ What systems can and should we change, and how?
- ★ How can we most meaningfully and effectively pursue our roles as solutionaries?

**Topical:**
- ★ What is a dead zone? What causes dead zones? What are the effects?
- ★ What are the biggest killers of people in the U.S. today?
- ★ What are some health problems that are largely caused by diet?
- ★ What choices have the biggest positive impact on both reducing ill health and the dead zone?
- ★ How are political/government, food/industrial agriculture, media, corporate/industry, and health care related to each other and this issue?
- ★ How do my/our personal choices contribute to the dead zone in the Gulf of Mexico? To diet-related disease?
Sample Standards from Common Core State Standards:

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Summative Assessments:
This six-week unit will end with the creation and presentation of a solutionary project. Based on topics covered in the unit and student interest, small groups (or individuals) will choose a relevant topic and create a meaningful plan for developing a solution to address the topic and implementing/sharing the solution with a real-world audience. Assessment will be based on the quality of the project via the project criteria requirements and a teacher/student created assessment rubric.

Additionally, students will complete an *end of unit reflection* to help confirm learning, analyze areas of concern, and reflect on their personal changes.
Formative Assessments:
Throughout this six-week unit, teachers will conduct formative assessments to help drive learning and understanding that meets the needs of each student. These will take the form of:

- student learning journals
- a whole-class mind map
- team systems/solutions maps (week 1)
- anecdotal records (written observations) collected by the teacher throughout the unit
- closing questions/thoughts: a formative assessment technique where students exit the room by handing the teacher a “ticket” with the answer to a question, solution to a problem, or response to what they’ve learned to show what they are thinking and what they have learned
- student-created products: e.g., mind map art, charts, Glogster poster, Popplet or Coggle, and sketch notes
Teacher Prep and Primary Materials:

- **learning journals**: comprehensive student created notebooks that chart the journey of learning throughout the unit; students will track: what’s learned, research conducted, reflections on how big questions relate to self and larger world, connections made, ideas about possible solutions, questions to research, and other relevant data to demonstrate students’ learning. The journal will help students consider: *How am I connected to the main question and what can I do about it?* (see week 1)

  - **mind map**: a dynamic, visual diagram used to record the collective, organic learning of connections, questions, misperceptions (and corrections) over the course of the unit (see week 1)

  - **closing questions/thoughts**: slips of paper or electronic means of recording answers completed at the end of a lesson

  - **large black and white U.S. maps** (see week 1)

  - **selected articles, videos, and other resources**

  - **smartboard, whiteboard, etc.**

  - **art materials**

  - **laptop, data projector, screen**

  - **internet access**

  - **guest speakers** (arrange for speakers either in-person or via Skype - week 2)

  - **field experience** (see week 4)
Six-Week Lesson Flow

Week 1: Say What?

Week One opens the unit by exploring the natural world with an outdoor activity to foster reverence and cultivate wonder. We’ll then begin to unpack the core question: *What do the primary causes of death in the U.S. have to do with the dead zone in the Gulf of Mexico?* by investigating ecosystems and learning about dead zones. Students will begin to examine how that question connects to their personal lives and to some of the relevant ecological and social systems.

Image via Institute for Humane Education
MONDAY:
Today we’re focusing on cultivating reverence and appreciation for the natural world by bringing students’ attention to nature. Because we tend to protect who and what we love, we’ll begin outdoors in a healthy natural area so students can deepen their wonder and love for the natural world. We’ll then focus on our personal impact on the earth’s ecosystems and end the lesson by introducing the unit question and discussing the expectations for the next six weeks.

Objectives:
Students will:
● develop increased reverence and appreciation for the natural world.
● analyze how their personal choices affect the environment.
● make observations about the key components in the unit.
● make inferences about systemic connections.

Mindful Moment:
Bring in a tray of bite-sized pieces of fresh fruit (preferably organic and in season). Let students choose one piece and notice it visually. Invite them to close their eyes and to smell the fruit before putting it in their mouths. Then invite them to slowly chew the fruit and swallow it, paying attention to the flavor and texture. Ask them to keep their eyes closed and to reflect upon how the fruit got from its place of origin into their bodies. Ask them to think about the natural systems involved in its creation: the sun, the soil, water. Ask them to reflect on the many individuals involved, such as: the pollinators and other insects, the workers. Ask them to consider the complex processes and systems involved in getting food from plant to table: agriculture, transportation, our economy, our cities, and so on.

Activity 1:
The Wonder Walk is an outdoor, sensory activity conducted any place in nature. This activity is done in pairs with a leader and follower. The leader guides the follower (whose eyes are closed) to experience various elements of nature via silent cues (tapping nose to smell a flower, tapping earlobe to listen to a bird call, etc.). The pair then switches roles half way through the activity.

After returning to the classroom, invite students to share any experiences from the Wonder Walk that were especially meaningful, surprising, or special to them. Have students reflect upon the fact that when we have deeper awareness and appreciation for the natural world and
other species, it can provide greater motivation for us to protect animals and the earth from harm and to take stock of our personal contribution to ecosystem health.

**Activity 2:**
Lead students in the initial activity [Leave Only Footprints](https://www.footprintnetwork.org/en/index.php/GFN/page/calculators/) to get them thinking about the impact of our choices on the earth. Everyone has an ecological footprint. Participants use paper footprints to simulate the impact of their choices on the earth. Extension activities allow students to explore their ecological footprints and what choices can be made to reduce them.

An alternative and/or extension activity could be:
Have students take turns deciding which option to choose.

**Activity 3:**
Introduce *learning journals* (a personalized notebook where students will track what’s learned, research conducted, reflections on how big questions relate to self & larger world, connections made, ideas about possible solutions, questions to research, and other relevant data to demonstrate their learning. The journal will help students consider: *How am I connected to the main question and what can I do about it?*

*See-Think-Wonder* activity:
Show students a series of images connected to the unit topic, such as these:

![Image via CAFNR/Flickr.](https://www.humaneeducation.org)
See: After students spend a few minutes silently looking at the images, have them respond to the See-Think-Wonder questions in their learning journals. Ask “What do you notice about these images?” (Have them focus on observations, not interpretations).

Think: Ask, “Based on what you are noticing, what does it make you think about? How do you think these images are connected? What kinds of interpretations/inferences can you form based on your observations?” and “What do you see that makes you say that?”

Wonder: Ask, “Based on what you’ve observed, what do you wonder about the images and how they’re connected?”

Have students meet with a few classmates to share ideas and thoughts by taking notes and documenting common and divergent perspectives. As a class, have students develop a wall chart to show the running record of initial understandings.

Introduce the unit question and explain the purpose of the unit - to ascertain the connection between the primary causes of death in the U.S. and the dead zone* in the Gulf of Mexico.

*Hypoxic zones are areas in the ocean of such low oxygen concentration that animal life suffocates and dies, and as a result are sometimes called "dead zones."

Let students know that they will be involved in developing solutions to the problems associated with ecological destruction and the prevalent causes of human disease. As they proceed through the unit they can begin to think of project ideas at any time and collect their evidence and develop their arguments in support of their project.

Closing Thought: I do/do not have a personal stake in this issue because….

(This response can help track changes in student perspective over the course of the unit.)
TUESDAY:
Today is all about exploring some of the interconnected systems in the unit, while digging more deeply into some preliminary knowledge around dead zones and their causes.

Objectives:
Students will:
- investigate the causes of dead zones.
- understand and think critically about the causes and effects of various food production systems and their impacts on the environment.
- interpret and compare maps, charts, statistics, etc.

Activity 1:
In the center of a digital space (e.g., smartboard, Popplet, Coggle) or large paper have the class start a mind map (see materials list). Write “primary causes of death/dead zone” in the center of the map. Based on student responses from yesterday’s See-Think-Wonder activity, have students share and add their observations/ reflections/ questions to the mind map. (If this is a physical map, you may want to have them use sticky notes. If this is a digital map, students should all have access so that they can add it to at any time.) Explain that the mind map will be used throughout the unit to collect information and help guide their quest for understanding and learning. (Note: At the beginning the students will likely have misconceptions; these will be corrected as students increase their knowledge.)

Activity 2:
Have students read the article “Why is This Year’s Gulf Dead Zone Twice as Big as Last Year’s” (14 August 2013), which will provide students with a brief overview of several of the issues involved.

Using sticky notes, have students pair up to focus on one of the following categories:
- record important facts from the article
- write down questions/concerns that arise from the article
- analyze relevant data from the maps/charts in the article
- record and define new unit-specific terminology
- follow up on links within the article
● note statements, statistics, etc., that “raise a flag” as needing further research (i.e., seem misleading, biased, etc.)

Have pairs spend some time researching their findings (facts, questions, data, terminology, links, concerns, etc.) and record what they discover.

Have each pair share with the class their research and findings being sure to explain their process.

Closing Thought: In their learning journals, have students reflect on these questions: How are we as humans connected to the dead zone? Why does it matter to us what’s happening there?

WEDNESDAY:
Today we’ll learn more about dead zones, become familiar with key vocabulary, and conduct research about dead zones based on student-generated questions.

Objectives:
Students will:
● understand what dead zones are, how they fluctuate, what causes them, and the effects of dead zones.
● define and explain phenomena in terms of key concepts (e.g., dead zone, hypoxia, phytoplankton bloom, nutrient runoff, monocrop).
● develop meaningful questions.
● research information to formulate answers to their questions.
● collect and display information by designing a digital poster to share with classmates.

Mindful Moment:
Have students close their eyes, and share the following visualization with them:
“Imagine that you are very old and at the end of your long life. You are sitting on a park bench, and the air is fresh, and clean, and fragrant with flowers. You can hear the sounds of birds and crickets. You are thinking back on your life, remembering when the earth was in grave danger, when wars, poverty, racism, ecological destruction, animal cruelty, and other forms of injustice and bigotry were commonplace. You smile, realizing that so many problems have been solved, that prejudice is a distant memory, and that people have learned to live harmoniously and
sustainably on the earth and with other beings. As you are imagining these changes, a child comes up to you and joins you on the bench. This child has learned about the problems the Earth, its people, and animals once faced and turns to you, asking what you did to help make the world so much better. What will you say to this child?"

Invite students to take a couple minutes to respond in their learning journals to the question in the visualization.

Warm-up:
Tell students that you’re going to show them two brief videos. Tell them: Keeping in mind the visualization from this morning and what we’ve learned so far, as you watch these videos, consider what questions arise for you related to a healthy marine ecosystem and a dead zone (e.g., What causes a dead zone? Can a dead zone be restored? What does an ecosystem need to be healthy?). Invite them to jot down some of their questions in their journals.

Show students a brief video showing the wonders of ocean animals and the marine ecosystem (the emphasis should be completely positive) and then a short video of the Gulf dead zone. Possibilities include:

Footage of beautiful creatures in Gulf:
NOAA Ship Okeanos Explorer: Gulf of Mexico 2012, Deep-Sea Marine Life (2:13 min)

Footage of Gulf dead zone:
Happening Now: Dead Zone in the Gulf (play from 1:15 - 1:39 without sound)

Let students know that they’re going to use the questions they just created as a springboard for learning a question-generating technique.

Activity 1:
Using the question focus: Relevant facts and connections about the dead zone in the Gulf of Mexico, introduce students to the Question Formulation Technique (from the Right Question Institute) and have small groups develop relevant questions to research about the dead zone.

Tell students that they should take the questions they generated while watching the brief videos and modify them, as needed, according to what they’ve learned from the Question Formulation Technique (see Appendix A).
(Students may develop questions such as:

*What is a dead zone? What are the causes? What are the attributes of a dead zone? What is nutrient runoff? What is hypoxia? How is the ocean connected to the oxygen we breathe? What is phytoplankton? Where are the richest sources of phytoplankton? What’s a plankton bloom? In what ways do humans affect phytoplankton? How does water density play a part? How do weather and seasons play a part? What is the current size of the dead zone in the Gulf of Mexico? Why is it always changing? What’s the economic impact of a dead zone? Are there other dead zones? If so, where and what are they caused by? Are they reversible? If so, how? Is climate change connected? If so, how?*)

**Activity 2:**
In their small groups, have students explore and answer their questions using a variety of resources. Encourage them to take careful notes and cite their sources.

Sample resources:
- Video: [The Dead Zone](#) (3:51 min)
- Interview: [Dead Zones Reversible, Virginia Biologist Says](#) (2:32 min)
- Article: [Ocean Dead Zones Are Getting Worse Globally Due to Climate Change](#)
- Article: [Dead Zone via National Geographic](#)

**Activity 3:**
Have the small groups create a digital display of their understanding using a platform such as [Glogster](#) (a digital poster) and share with the class.

Add relevant information to the class mind map and learning journals as you go.

**Closing Thought:** Using a tool like [Answer Garden](#) (a real-time feedback tool) have students respond to at least: 3 connections they’ve made regarding the core question (What do the primary causes of death in the US have to do with the dead zone in the Gulf of Mexico?) and 2 questions they have about the topic.
THURSDAY:
Today we will discover what constitutes a healthy ecosystem and learn about some of the effects of unhealthy ecosystems. We'll also spend time learning more about the Mississippi River and its connection to food production and dead zones. Students will immerse themselves in collaborative work using maps to help demonstrate what they have learned so far.

Objectives:
Students will:
● assess what constitutes a healthy ecosystem.
● identify why healthy ecosystems are important.
● apply concepts and understanding of dead zones.
● design, hypothesize, and label U.S. maps with key concepts.
● work collaboratively to formulate problems and possible solutions to dead zones.

Mindful Moment:
Invite students to close their eyes and imagine a place of natural beauty that they love and/or which is important to them. Have them write about or draw a picture in their learning journal of this place and answer these questions:

a) How did you come to know and care about this particular place? What is special about it?

b) If the wildlife who depend on that place could speak to you, what do you think they would say?

c) What would you be willing to do to defend or protect this place? Why?

Give students a few minutes to discuss their responses with a partner.

Warm-up:
Watch How Wolves Change Rivers (4:33 min) and lead a brief discussion (including research if necessary) about what constitutes a healthy ecosystem. Have students add any new knowledge, questions, and insights to the class mind map and their own learning journals.

Activity 1:
Show students relevant excerpts from Troubled Waters: A Mississippi River Story (57 mins) (available through Interlibrary Loan), which tells the story of the unintended yet severe
consequences of large-scale, monocrop farming along the Mississippi, and the efforts being taken to reverse this damage.

As students watch excerpts have them take notes on what they’re learning, focusing on issues such as:

● What are the core problems defined in the film?
● What are the causes of these problems?
● What systems are involved?
● Who is affected (humans, animals, biosphere?)
● What are some of the proposed solutions?
● Who is responsible?
● Who is taking action?

Activity 2:

1. Have students get into teams of four. Give each team two large outline maps (black and white) of the United States (alternatively, do the same with an electronic map), sticky notes, markers, colored pencils, and other similar materials.

2. One pair of the team will use what they’ve learned so far (from Day 1 through today) to add information and relationships to their map showing the negative impacts of the systems and topics related to the core question (death/dead zone). For example, they might:
   ● indicate where large concentrations of corn and soy are grown near the Mississippi River or waterways that empty into the Mississippi River;
   ● show where CAFOs (confined animal feeding operations) are established near the Mississippi River;
   ● show the flow of fertilizer and other chemical run-off down the Mississippi River to the Gulf of Mexico;
   ● indicate the current size of the dead zone in the Gulf;
   ● tie the growing of monocrops and raising of farmed animals to large companies that create unhealthy and processed foods;
   ● connect American consumption of unhealthy foods with diet-related diseases.

Working in tandem with the first pair, the second pair of students will use their map to show how some of the systemic damages being caused and hypothesize how the
components of those systems can be transformed to be more restorative and healthy (including for the ecosystems involved). For example, they might:

- convert industrial monocrop farms to organic, sustainable and regenerative (e.g., permaculture) farms growing a diversity of healthy foods;
- implement land preservation measures in key areas;
- show that CAFOs can be eliminated by choosing a plant-based diet;
- indicate additional strategies for reducing the dead zone in the Gulf;
- initiate healthy food programs in schools and communities.

3. The teams of four will collaborate with each other. After they’ve had time to start their team maps, the “problems” and “solutions” pairs will also work with other student pairs with like-categories to be able to provide the most accurate and meaningful representations possible.

4. Have the teams hang their maps on the walls next to each other, and give the class time to walk around the room looking at the maps.

5. Lead a brief discussion to help students clarify thinking, make additional connections, and note what information they lack.

Let teams know that as they learn more during the unit, they can add the negative impacts and suggested solutions to their maps.

Add to the class mind map and learning journals as you go.

Closing Question: Why do healthy ecosystems matter? What’s my role in both protecting and restoring ecosystems?

FRIDAY:
Today we’re jumping into everything health-related. From learning to critically analyze news stories and scientific research to discussing plant-based diets and societal systems that impact food choices, we will spend the day learning about some of the leading causes of death in the U.S. and how what we eat is related to the dead zone.
Objectives:
Students will:
- investigate causes of death in the U.S.
- critique diet/health-related news stories for bias, framing, misinformation, and misleading statements.
- analyze news stories and scientific research.
- draw connections between diet and health.
- assess what societal systems are involved (e.g., political/government, food/industrial agriculture, media, corporate/industry, health care), and the role these systems play, in influencing policy and choices regarding health.

Activity 1:
Have students share what they think are the leading causes of death in the U.S. and jot down a list on the whiteboard/smartboard.
Show students a slide with the primary causes of death (via the CDC website).
Ask students to compare their own list with the CDC list and discuss similarities and differences. What surprised them? What commonalities do they notice (e.g., several are diet-related)?

Ask students what they know (or think they know) about the contributing factors for each of the primary causes.

Individually, have students do quick web search on the causes and their contributing factors (using tools like WebMD). Share with the group.

If students haven’t already made the connection, guide them to noticing that several of the causes (heart disease, several kinds of cancer, stroke, diabetes) are often diet-related.

In groups of three, have half the groups do a preliminary web scan for news stories on “cardiovascular disease and diet” and the other half of the groups do a preliminary web scan on “type 2 diabetes and diet.” Take notes on:
- What are the major themes and conclusions mentioned in the stories?
- What are the sources of information cited in the stories?
- What are the general (overt and subliminal) messages being conveyed?
Mention to students that articles (health-related and others) can include bias (including whoever funded the work, for example), misinformation, misleading statements and statistics, etc., so it’s important for us to bring our critical thinking skills to what we read and view.

Show Battling Bad Science by Ben Goldacre (TEDx talk, 14 min.). Use these questions as a guide to collecting information:

- What is the weakest form of evidence? *(authority)*
- Why are studies in humans so important? *(Scientific experiments can show one thing in a controlled laboratory situation that is completely irrelevant and ineffective for humans.)*
- Give one example from the talk that demonstrates how scientific research can be skewed.
- What is a (clinical) trial? *(Experiments and research studies conducted in clinical research often done as a comparison of two groups with one group being a control group.)*
- What is a placebo effect?
- What is the danger of industry-funded trials? *(They are 4x more likely to have a flattering result for the new drug due to skewed dosing and results.)*
- How can you determine if data has been deleted from a study? *(Examine statistics like plot graphs and/or research stories of companies withholding data from studies.)*

Have students read these three articles about scientific studies:

- 6 Ways Scientific Studies Can Trick You (9 May 2013)
- What Do Scientific Studies Show (25 April 2013)
- Can I Trust This Study? (23 October 2014)

Lead students in a discussion about how what they learned in the video and news stories informs how they might view news stories and scientific research about health-related information. Highlight that many news stories and even some research studies are biased, conflicting, misleading, etc.

Ask: How can we find out which news stories and studies are accurate and credible? (Refer especially to the “Can I Trust This Study?” article.)

Activity 2:
Watch relevant excerpts from the films Forks Over Knives and How to Get Fat Without Really Trying. While students are watching the film excerpts, have them take notes in their learning journals using the Four Corners strategy on the following topics: (Have students
divide their paper into four quadrants and then give the four topic headings for each quadrant. Then as they watch the film, they make notes for each of those four headings.)

- Facts or statistics that stand out and/or that seem to need further investigation.
- The names and roles of the people who spoke in the film (and the relevant companies/entities/individuals who did not).
- Questions they have that they want to follow up on.
- Suggestions for solutions (both individual and systemic).

Lead a debrief of the films, inviting students to share what they recorded, what they think they learned, what they think about the films, any concerns or questions they have about accuracy or bias, and how the films relate to the core question (deaths/dead zone).

Closing thought: Have students share at least 3 facts, 2 questions, and 1 opinion about what they’ve learned so far.
Week 2: Digging More Deeply

In Week Two we’ll go deeper. We’ll continue exploring the core question and take it further as the students examine various systems connected to the issue: health care, food, media, corporations, and the political system. Through small group research projects, students will uncover how each system is connected to the unit question and interconnected to each other.

Image via USDA/Flickr
MONDAY:
Today we’ll spend time learning more about how the systems and issues in the unit are connected. From here, we will prep for a week's worth of deeper research on the systems in the unit.

Objectives:
Students will:
- identify and describe relationships between the systems, topics, and issues related to the unit.
- critique news stories for bias, framing, fact, opinion, and credible information.
- understand how to use inquiry skills to think critically and deeply, and make connections about what they read, view, and uncover.
- be able to conduct meaningful research:
  - assess findings for accuracy and validity
  - analyze collected data
  - draw justifiable conclusions and cite evidence.

Mindful Moment:
Focus on one little thing that you appreciate (e.g., socks, water, music) and create a link in your mind to all of the beings and processes that are connected to that thing — that have put in effort for you to have that particular thing, from all that was involved in its creation, to how it became something that you have/use.

Warm-up:
Briefly review and highlight some of the topics and ideas from the class mind map. What topics, issues, and systems are most relevant to the core death/dead zone question? What are the most important lessons we’ve learned so far? What questions remain unanswered? Give students a couple minutes to silently reflect on the questions/mind map and to jot down notes, if desired.

Activity 1:
Have each student choose one of the systems, topics, issues, or ideas identified from the mind map (or their own journals) and write it on a name tag (or something similar) and put it on their chests.
Have students stand in a large circle facing each other (divide into two groups if there are more than 20 students in your class). Give one student a large ball of yarn and ask them to choose one of the other systems/topics/ideas and name one way theirs is connected; then have the student hold onto the end of the yarn and toss the yarn ball to that student, who will choose another and name a connection (holding onto the yarn and tossing it to another student), and so on, with students repeatedly making connections that are reflected by all the criss-crossing of the yarn ball.

As students call out these connections, write them on the whiteboard/smartboard.

After students have made as many connections as they’re currently able, lead them in a discussion (referring to the whiteboard) about what they’ve discovered. Fill in important gaps.

Activity 2:
Introduce the process and template for investigating and researching systems related to the core question (What do the primary causes of death in the US have to do with the dead zone in the Gulf of Mexico?). Explain that as activities proceed during the week, students will add to their research topics.

Process: Divide students into five groups. Each group will research and present on a different system:

- political/government: subsidies, taxes, economics, lobbying and campaigns, government policies
- food system: school lunch, CAFOs, industrial agriculture, monoculture and fertilizers/pesticides
- media: influence of news and advertising
- corporations/industry: advertising, corporate rights
- health care: diet-related disease, public health (especially as it relates to diet), nutrition education in medical school, preventive medicine versus disease-focused medicine

Research Project Template (See Appendix B):

Requirements:

- I-Search narrative research paper
Activity 3:
Referring back to the critical thinking and research review on Friday (week 1), discuss with students the importance of accurate information and thinking critically about what resources are used in their research. Explain to students that we are often faced with all sorts of resources from a variety of stakeholders who may be using bias, framing, or other strategies (consciously or not) to sway readers to their viewpoints. Since bias is a part of almost every resource, how do we determine what resources are most credible? How do we determine what's true?

Have students watch this video:

**How to Separate Fact & Fiction Online** by Markham Nolan (TED talk, 13:29)

Have students do one of the following:

A. Choose a fairly recent news story (within the last two years) that takes a stance related to something connected to one of the systems in the unit (e.g., about diet, pesticides, political contributions, animal agriculture). Now dig deeper into that issue to uncover the truths (and any inaccuracies, oversimplifications, intentionally misleading information, etc.).

B. Choose two news articles on the same topic (a topic related to one of the systems in the unit) that include conflicting information (for example: that eating animal products is healthy; that eating animal products is not healthy). Do some research to determine what information is accurate, and what information is incorrect, skewed, oversimplified, etc.

Note: To help students with this activity, you may want to direct them to resources such as:

This guide to evaluating information sources
https://library.uoregon.edu/guides/findarticles/credibility.html

or a guide such as the one outlined in the Be A C.R.I.T.I.C. activity
http://humaneeducation.org/blog/resource/be-a-c-r-i-t-i-c/

Have students write a summary of what they discovered and what they can do to ensure the information they’re using is accurate and credible. Invite students to share.
Closing Thought: List as many ways you can think of that your own life choices impact yourself, other people, animals, and the earth in relation to the connection between the primary diet-related causes of death and the dead zone in the Gulf of Mexico.

TUESDAY:
Let’s practice some critical thinking! Today’s lesson will start by critically analyzing a personal belief and then jumping into examining the health care system by viewing a documentary on obesity and the health care system. The second part of the day will be spent working on research papers.

Objectives:
Students will:
  ● apply critical thinking skills to examine a personal belief
  ● practice creative note-taking skills.
  ● examine the systems and issues involved in health care.
  ● analyze a film for bias, framing, accurate information.
  ● assess how food choices affect health.

Warm up: Have everyone identify a belief they have about something related to one of the systems they’ve been studying (government, food, media, corporations, health care). Then have students complete the questions (See Appendix C). Have students share with a partner their thoughts and reactions to the activity. Invite students to share with the class.

Activity 1:
Show students relevant excerpts from the documentary Fed Up, an examination of America’s obesity epidemic and the role of the food industry, government, and advertising in exacerbating it.

Have students use a creative method such as Sketch Notes (illustrated notes) for taking notes on the film.
While students are watching the film, have them take notes on issues such as:

- What societal systems are involved (e.g., health care, media, government), and the role of those systems, in influencing policy and choices regarding health care.
- Facts or statistics that stand out or that seem to need further investigation.
- The names and roles of the people who spoke in the film (and the relevant companies/entities who did not).
- Questions they have that they want to follow up on.
- Preliminary suggestions for solutions (both individual and systemic).

Lead a short debrief of the film, inviting students to share what they think they learned, what they think about the information presented, what they would have to research to ascertain validity, and how the film relates to the big question (deaths/dead zone).

Have students hang their Sketch Notes on the wall.

Research Project Work:

*Mini-lesson:* Conducting an interview

Students will continue to research their chosen system and prepare their presentations. Meet with groups as needed.

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**WEDNESDAY:**

Today’s focus is all about government subsidies: what they are, why they exist, and their benefits and harms. We will examine two food items and compare how their cost is influenced by subsidies and the economic and political systems that lead to those subsidies. The second part of the day will be spent working on research papers.

**Objectives:**

Students will:

- compare and contrast the cost of food items.
- examine why foods are more or less expensive than others.
- define and explain key terms (e.g., subsidy, Farm Bill, industrial agriculture system)
- investigate government subsidies (like the Farm Bill) and how they affect the health of people, animals, and the planet.
Warm-up:
Have students do some quick research on how much a fast food cheeseburger costs and how much a veggie burger costs.

Lead them in a discussion about this question: Why is a fast food cheeseburger cheaper than a veggie burger?, highlighting what systems are involved in this question and why. (Be sure that the issue of food subsidies is mentioned as part of this discussion.)

Activity 1:
Have students work in pairs to complete a webquest answering the following questions:
- What is a subsidy and what is its purpose?
- Name at least three types of government subsidies.
- What are some of the benefits of subsidies?
- What are some of the problems with subsidies and for whom?
- What could be done to promote a healthy, sustainable agricultural system instead of (or in addition to) using subsidies?
- In your opinion, which subsidies should change or be eliminated and why?

Activity 2:
Share the infographic: The Hidden Costs of the Farm Bill. Have students watch the TED Talk: Turning the Farm Bill into the Food Bill by Ken Cook and read the two articles Our Water-Guzzling Food Factory and Our Crazy Farm Subsidies, Explained.

After viewing the infographic, reading the articles, and watching the TED Talk, have students gather for a Socratic discussion on the Farm Bill and how it is related to public health and the dead zone in the Gulf of Mexico.

Use the mind map to record questions, concerns, and possible solutions as they arise.

Research Project Work:
Mini-lesson: Review elements of a dynamic Prezi via 8 Tips for an Awesome Prezi
Students will continue to research their chosen system and prepare their presentations. Meet with groups as needed.
THURSDAY:

We will investigate advertisements related to the systems being studied and how these ads influence our values and beliefs. The second part of the day will be spent working on research papers.

Objectives:
Students will:

- critically analyze advertisements and their impact on individuals, culture, and behavior, and their hidden effects on other species and the environment.
- identify how advertisements influence values and beliefs.
- design a mathematical model to illuminate a problem or situation related to the system being researched.
- formulate questions for expert speakers (the following day).

Activity 1:
Preparation: On a Pinterest board, gather a variety of age-appropriate ads (from print, TV, the web, etc.) related to food, health care, etc. (the systems being studied); have enough that small groups of students can have several to examine.

1. Share the link to the Pinterest board with students. Demonstrate how to analyze the product(s) being advertised and the messages embedded in the ads, using the following questions:
   a. What product or service is being advertised?
   b. What deep need or desire is the ad promising to fulfill? (e.g., love, happiness, wealth, beauty, friendship, joy?)
   c. Who is the intended audience? What might their response to the ad be?
   d. What suffering, exploitation, or destruction is hidden from view? (i.e., what suffering to people or animals does the production of the product or the generation of the service lead to, and/or what destruction to the environment does the product or service cause?)
   e. What product/service might do more good and less harm than the one being advertised?
f. What systems perpetuate this produce and what shifts in systems would lead to healthier alternatives?

2. Organize groups of 3-5 students. Ask each group to analyze several ads, using the questions above.

3. Have each group report on one of the ads to the class.

4. Facilitate a discussion about how students perceive advertising in a different light now that they’ve done the exercise; why it’s difficult to resist the cultural tide of common choices promoted through advertising, and how their critical thinking skills might enable them to make choices based on their values and research-based beliefs.

Research Project Work:
*Mini-lesson:* Address any challenges you’ve noticed students having with creating their mathematical models.

Students will continue to research their chosen system and prepare their presentations. Meet with groups as needed.

**Closing thought:** Prepare for tomorrow’s guest speakers by sharing a brief bio of each. Have students develop several questions to ask the guest speakers.

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**FRIDAY:**
Today we’ll have the opportunity to hear directly from experts in the field. By asking thoughtful and purposeful questions, we’ll better understand how the USDA and industrial animal agriculture relate to the unit question, systems being studied, and come up with ideas for solutions to current challenges. The second part of the day will be spent working on research papers.

**Objectives:**
Students will:
● identify key questions for expert guests.
● evaluate the role of the USDA in trying to both market commodities and protect and regulate the food system.
● understand what CAFO’s (confined animal feeding operations) are and draw conclusions about their impacts on people, animals, and the environment.
● create a slideshow for their presentation.

**Intro:** Have students take a few minutes to review their questions, share their questions, and create additional questions.

**Activity 1:**
Students will be joined via web conferencing by two guest speakers who can speak about the USDA and about CAFOs, for example: a representative from the USDA who will talk about the role of the USDA in marketing commodities and protecting and regulating the U.S. food supply, and an author and journalist who is an expert in industrial animal agriculture, including CAFO’s.

The guest speakers will each give a brief presentation, and students will ask questions, taking notes in their learning journals.

**Research Project Work:**
**Mini-lesson:** Review APA format for works cited for I-Search paper
Students will continue to research their chosen system and prepare their presentations. Meet with groups as needed.
Week 3: Rolling our sleeves up...

Week three starts with student peer teaching using Prezi (or similar) presentations and I-Search papers. It’s then on to exploring the *True Price* of everyday items to assess our personal choices and their effects.

[Image via Yosomono/Flickr]
MONDAY:
The bulk of today will be spent on the finishing touches for research papers and slideshow presentations, but we'll start today by examining mindful speech in preparation for presenting information and teaching others.

Objectives:
Students will:

- investigate and analyze their language choices.
- use narrative voice in their I-Search papers.
- support ideas with details and examples in their I-Search papers.
- cite evidence through research paper references.
- synthesize their research information into a presentation.
- demonstrate use of research skills and collaboration to prepare their presentations: information-seeking strategies, location and access of accurate information, use of information, synthesis, evaluation.

Mindful Moment:
As students prepare to present, and to be mindful, constructive audience members, lead them in thinking about mindful speech via the T.H.I.N.K. questions. Here's one example:

The T.H.I.N.K. questions ask us to be mindful of our speech by considering:

- Is what I want to say True?
- Is what I want to say Helpful?
- Am I the best one to say it?
- Is it necessary to say it Now?
- Is it Kind to this person and others?

~ Dr. Christopher Willard, Mindfulness for Teen Anxiety

See Appendix D for sample questions.

Questions for further reflection and discussion:

- In the above situations, how could “I” have chosen to respond differently, and what impact would that have had on other people?
● Did any of the situations remind you of something from your own life? What happened, and did you and the other people involved T.H.I.N.K. before you spoke?
● Have you ever said something that was true but unkind or kind but untrue?
● Is it possible to say something kind but unhelpful?
● How can we offer feedback that’s constructive, rather than demeaning?
● How can we communicate with others about challenging issues in a compassionate and mindful way?

Research Project Work:
Today students will spend the block working in groups on their research projects. Offer mini-workshops and confer with groups as necessary.

Possible mini-workshops students can sign up for:
● using APA format
● creating a math model
● troubleshooting Prezi (or similar)

Tuesday:
Presentations! Today we get to learn from each other as student groups share with the class what they’ve learned about their specific system using a Prezi (or similar) slideshow.

Objectives:
Students will:
● present information gained from their research paper and slideshow.
● synthesize information gleaned from peer presentations.
● apply what they’ve learned from the presentations to what they’ve already learned about the core question.

Today student groups will present their slideshow presentations, give a brief overview of their I-Search papers, and share their mathematical models. Each presentation will be followed by a teacher-led Q&A session for the group. During the presentations audience participants should record questions they want to ask presenters during the Q&A session.
Allow time for groups to add pertinent information to the mind map, their team maps, and to individual travel journals.

**Closing thought:** Share two new things you learned today about each of the five systems.

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**WEDNESDAY:**

How much does something *really* cost? Today we will spend time investigating the true price of a cheeseburger, including its effects on humans, animals, and the environment and exploring the systems that are involved with its production. We’ll also consider the impacts of our choices on others and the alternative choices we can make to do more good and less harm.

**Objectives:**

Students will:

- assess how our choices impact ourselves, other people, animals, and the earth.
- think critically about how products affect humans, non-human animals, and the environment.
- investigate the interconnectedness of issues and influences related to humans, non-human animals, and the environment.
- generate potential solutions for doing more good and less harm for all.

**Mindful Moment:**

Ask students to sit comfortably, close their eyes and take some deep breaths. Invite them to reflect upon what they’ve learned thus far in the unit and ask them to reflect upon the word “responsibility.” Share Abraham Heschel’s quote: “… in a free society, all are involved in what some are doing. Some are guilty, all are responsible.” Allow them five minutes of silence in which to consider what this quote means to them personally. Then ask them to write their thoughts for 10 minutes and share with a partner.

**Warm-up:** Show the video “[5 Human Activities You Can See From Space](https://www.youtube.com/watch?v=5f5f5f5f)” (2:39 min) Lead students in a brief discussion of how our personal and systemic choices can positively and negatively affect people, animals, and the environment.
Activity 1:
Introduce students to the concept of the True Price of a product. Lead the class in True Price, using a cheeseburger as the product:

1. Is this item more a want or a need for you? What about for people in circumstances different from your own? Should this question matter to us in how we make choices?
2. What are the effects of this item on:
   a. you as an individual?
   b. other people?
   c. other nonhuman animals?
   d. the environment?
3. What are the systems that support, promote, and perpetuate this item?
4. What would be an alternative that would do more good and less harm?
5. How can we further develop just, peaceful, and sustainable alternatives and systems and make these ubiquitous?

Give students time to ask questions about and give feedback on the True Price activity.

True Price Project introduction (Day 1): As individuals or pairs, students will be doing True Price on a product from one of the researched systems within the context of the core (death/dead zone) question (e.g., fast food, junk/snack foods, soda, fertilizers, a drug used to treat heart disease).

Give them a template with the questions and elements they need to focus on (See Appendix E).

Field any questions.

Give students time to start their True Price projects.

Add to the class mind map and learning journals as needed.

Closing Question: What is one choice I can make that will do more good and less harm for other people, animals, the earth, and myself? How can I work to positively influence others?
THURSDAY:
Today we will continue collaborative work by exploring the true price of items related to the systems within the context of the core question (e.g., fast food, junk/snack foods, soda, fertilizers, a drug to treat heart disease).

Objectives:
Students will:
● assess how our choices impact ourselves, other people, animals, and the earth.
● think critically about how products affect humans, non-human animals, and the environment.
● investigate the interconnectedness of issues and influences related to humans, non-human animals, and the environment.
● generate potential solutions for doing more good and less harm for all.
● extrapolate what they’ve learned from this exercise by applying new concepts to the bigger picture of our impacts on and influences of systems.

Activity 1:
(Day 2 of True Price) Individually or in pairs, students will complete the True Price project template, conducting relevant research.

Monitor groups and assist as needed.

FRIDAY:
Today is all about getting our creative juices flowing! Students will spend time creating and presenting their True Price findings via illustrated Mind Map Art.

Objectives:
Students will:
● describe the cause and effect of a particular item.
● create a visual representation of the true price of a particular item.
● analyze the true price of other items.
● think critically about their consumption habits.
Mindful Moment:
Have students take a few moments to imagine their lives in the future. Ask them to write for the next few minutes on the following: What is the best possible life you can imagine? Consider all of the relevant areas of your life, such as your future career, citizenship, relationships, hobbies, and/or health. What would happen in these areas of your life in your best possible future?

Activity 1:
Introduce students to the concept of Mind Map Art (a mind map that captures a visual representation of the relevant ideas and concepts) and let them know they’ll be creating a visual representation of their True Price project using the Mind Map Art format. Using the cheeseburger example from earlier, have students guide you in creating an artistic mind map. (Alternatively, you may want students to break into pairs or small groups to create a visual representation.)

Here’s an example of Mind Map Art:

![Mind Map Art Example](Image via Sharon Brogan/Flickr)

In their groups students will create their artistic mind maps. Monitor groups and assist as needed.

Activity 2:
Have students post their artistic mind maps on the walls when they’re finished and take turns briefly introducing them to the class. Have students do a gallery walk of the artistic mind maps, recording questions and comments about what they noticed (e.g., new connections, new
information about systems, ideas for solutions, topics for further research) in their learning journals, and discussing the maps with their peers. Bring the class back together to discuss what was learned and make final conclusions about what they saw and discussed with each other.

**Closing Question:** Prepare students for next week’s work and assess what they know by having them consider and reflect on: How can individual (or small groups of) citizens influence systems in a meaningful way? What are some of the obstacles to influencing systems?
Week 4: I think I got this!

Week four is steeped in application and prepping for solutionary project work. This week we will hear from other solutionaries, explore elements of design thinking, and narrow down solutionary project topics.

Image via Innovation School
MONDAY:
Today we're heading out into the world to examine various problems and solutions (based on field experience location).

Objectives:
Students will:
- make observations of real-world issues and assess possible solutions (these will be dependent upon the location of the field experience).
- think critically about the impact of our choices and systems on people, animals, and the earth and formulate alternatives that can do more good and less harm.

Today the class will go on a field experience.
Some suggestions:
- Visit a permaculture farm to see a healthier, more restorative food system.
- Visit a supermarket to read labels: percentage of aisle space in supermarkets devoted to processed vs. whole foods, finding how many items in an aisle have corn oil? What percentage is organic?
- Visit a drug store to see what is sold that harms health (junk food and soda and often tobacco) and what is there to promote health as opposed to alleviate/cure sickness and pain?
- Visit a farm animal sanctuary to learn about animals used in our food system and meet and hear the stories of individual animals.

TUESDAY:
Through storytelling, video, and guest speakers we will spend today learning about solutions and solutionaries. Using these as inspiration, students will begin to brainstorm their own solutions for problems related to systems and the core question.

Objectives:
Students will:
- investigate solutionaries.
- recognize that we all have the power to be solutionaries.
• distinguish between various solutions, understanding that some are more effective, comprehensive, and meaningful than others.
• understand that individuals and communities can influence systems in a variety of ways.

**Warm-up:** Show students the short film *The Power of One.* Have students write a brief reflection/response to the film in their learning journals. Invite students to share.

**Activity 1:**
1. Write “What does it take to transform an unjust or unsustainable system?” on the whiteboard/smartboard.
2. Share stories of solutionaries who have made a difference related to one or more of the systems they’ve been studying (e.g., food system, politics, media). You could show video clips, tell stories, and/or Skype in guest speakers.
3. Using a digital platform like Answer Garden, a collective Google doc, or scrap paper, ask students to answer the question written on the board.
4. Have students share sample responses and discuss as a class.
5. Divide students into groups by the systems explored in the unit (e.g., health care, food industry, government, corporations, media). Ask each group to do the following:
   
   A. On one sticky note, have students write one thing they want to change within a system.
      
        On another sticky note, have them write what challenges they face in making that change.
   
   B. In pairs, have students discuss their notes.
   
   C. On a whiteboard, create two columns: want to change and challenges. Have students place their sticky notes under the appropriate column. Discuss as a whole group.

**Activity 2:**
Explore with the class some of the root solutions that are needed to address the challenges within these systems. Examples might include:

• Eliminate agricultural subsidies for anything unhealthy, cruel, and/or environmentally destructive and energy-intensive
• Include true costs of environmental impacts in prices of foods
• Eliminate vending machines with junk food/sodas in our school
• Transform the school cafeteria so that it serves healthy, sustainable, humane foods
• Reform campaign financing
• Add language about protecting health and the commons to corporate charters
• Change laws to prevent corporations from having the rights of persons without the concomitant responsibilities
• Change laws to prevent dishonest, misleading advertising
• Limit advertising of unhealthy products (as was done with tobacco and alcohol)
• Shift to organic, sustainable agriculture that doesn’t rely on artificial fertilizers; provide financial incentives to organic farmers
• Use remediation techniques (e.g., mycoremediation) to prevent toxic run-off
• Utilize permaculture systems for agriculture

Engage students in a discussion about these root solutions, including:
What are the challenges for individuals in influencing systems? How are such systemic solutions connected? What can individuals and communities do to influence systems?

Activity 3:
Discuss and brainstorm with students possible solutionary projects they might be interested in addressing. Here are just a few possibilities:
• Students present to an elected official with 1) concerns 2) good questions 3) proposed legislation on a particular issue/challenge.
• Students address the food systems via school; e.g., create a month-long meal plan for school that is healthy, humane, sustainable, and primarily local and organic and present it to school administrators.
• Students develop a peer or public education campaign; e.g., ad campaign, video, op-eds, play or spoken word, to increase awareness about a particular issue/challenge and some meaningful solutions.
• Students develop/research a science-based solution, e.g., mycoremediation to prevent pollutant runoff; sustainable agriculture systems
• Students create a “solutionart” installation (art with a solutionary focus) involving one or more of the systems explored in the unit.

Closing Activity: List some ideas for your solutionary project.
WEDNESDAY:
Today we will be immersed in design thinking and the design stages. Through hands-on practice, students will begin to formulate a viable solution for their solutionary project.

Objectives:
Students will:
● gather knowledge of the design thinking process by analyzing short films.
● define the design thinking process.
● practice applying the first two stages of design thinking.
● explore creating viable solutions to a real world problem by utilizing the design process.

Activity 1:
Using the Design Thinking for Educators Toolkit, introduce design thinking through a mini film festival. Ask students to pay attention and document the design thinking processes being used.

1. Design & Thinking movie trailer (2:27)
2. Complex Systems Design (8:11)
3. Example of a High School Design Project (2:22)

Discuss the films as a whole group, being sure to answer questions and record ideas and thoughts on the class mind map.

Activity 2:
Explain the five stages of design thinking:

Share keys to design thinking (via Design Thinking for Educators Toolkit):
• You are a designer.
• Embrace your beginner’s mind.
• Step out of your zone of comfort = learning.
• Problems are just opportunities for design in disguise.

Walk students through the process of design thinking with sample solutionary project:

addressing school cafeteria and food systems in school

1. Define the problem: (e.g., school cafeteria food is often unhealthy and low quality)
2. Reframe the problem via “how might we” questions. Use the chart below to begin brainstorming (See Appendix F):

<table>
<thead>
<tr>
<th>Dreams/Things I Wish Would Exist</th>
<th>How might we...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy and high quality food for all students.</td>
<td>How might we design a school cafeteria menu using local, humane, and organic foods?</td>
</tr>
</tbody>
</table>

3. Using the suggestions generated in the chart, decide on which challenge to focus and create a project plan and timeline:
   a. End goals
   b. Define indicators of success
   c. Establish constraints
   d. Other things to keep in mind
   e. Project checklist
   f. Sketch a timeline

4. In small groups have students practice Discovery Through Empathy by roleplaying stakeholders asking: who does this most affect? (student, administration, parent, school cafeteria manager, food rep, chicken/cow, river/ocean, forest, etc.).
5. As a whole group, have students practice Interpret & Define by using the points of view to create a profile to define stakeholder concerns, recurring themes, and possible solutions.

Closing Activity: Debrief the first two stages of design thinking process. What works? What’s challenging?
THURSDAY:
Today we will continue to be immersed in hands-on practice of design thinking and the design stages. Students will continue to work on formulating a viable solution for their solutionary project.

Objectives:
Students will:
● define and summarize the design thinking process and all five stages.
● practice applying the steps of design thinking.
● create viable solutions to a real world problem by utilizing the design process.

Review the design thinking process and yesterday’s work by discussing the stages of design thinking.

Activity 1:
1. Using the results from the first two stages, have students practice Ideation by brainstorming: what can be created to address the concerns? Allow a range of ideas to flow to encourage creativity and critical thinking. Help students refine ideas and ultimately choose one solution to evolve.
2. Upon selecting one solution, students will work in small group, pairs, or individually to practice Prototyping and Experimentation: Solutions for Change by sketching, creating stories, mock-ups, models, role playing, etc. Have students share ideas with the whole class and allow time for feedback and honest conversations.
3. Because this is a condensed practice of design thinking, guide students through the Evolution stage by sharing how they can use test data and feedback to document progress, move forward, engage others, and plan for sustainability for humans, animals, and the earth.

Activity 2:
Debrief the final three stages of the process. What works? What was challenging? Prepare students to be thinking about a design plan for their own solutionary project ideas.

Closing thought: Share one aspect of design thinking you are excited to explore with your own solutionary project idea.
FRIDAY:
Understanding what constitutes an effective solution is the focus for today. We will spend some time working together to finalize solutionary project ideas.

Objectives:
Students will:
- analyze and understand what makes an effective solution.
- create a solution that is both meaningful, effective, and interests them, and that is beneficial for people, animals, and the earth.
- utilize a brainstorming tool to help formulate a solutionary project.

Warm-up: Show students the video I Will Be a Hummingbird with Wangari Maathai (2:01 min)

Activity 1:
On a wall-sized piece of paper, have students take turns compiling a list of all the potential solutions that have been raised throughout the unit. (Students will want to consult the class mind map, their team maps, and their learning journals.)

Activity 2:
Lead a discussion about what makes a good solution:
- Solutions are dependent upon accurate information and multiple perspectives.
- Solutions emerge from strategic, holistic, creative thinking.
- An ideal solution is good for all people, animals, and the ecosystems that sustain life.
- An ideal solution addresses root problems.

As a class, review some of the solutions on the paper and circle those that meet the criteria for a good solution.

Activity 3:
Have students discuss with each other possible solutions that are both meaningful/effective and that interest them. As new solutions ideas arise, have students add them to the large paper.

Have students that are interested in similar solutions group up. Students may also work on solutions individually.
Activity 4:
Review the Solutionary Project Brainstorming Guide and answer any questions. Give groups/individuals time to start working on the guide.

Also review the criteria for the Solutionary Project:
- The project clearly outlines a problem relevant to the core (death/dead zone) question.
- The project clearly states desired goals and outcomes.
- The solution helps people, animals, and the environment and doesn’t cause harm to any of these groups or individuals.
- The solution positively addresses the relevant problem.
- The solution is meaningfully practical, actionable, and cost-effective.

In addition to the components above, students and teacher together will create an individualized Solutionary Project Rubric Template that reflects the unique elements of each project.
Week 5: Eureka!

This week is where we dive into major research mode and solutionary projects start to come alive. In both small groups and as individuals, students will research and investigate the topic for their solutionary project. Teachers, this is your time to work with small groups and confer with students on their projects as necessary.

Image courtesy David Sidwell
Week 6: Show us what you got!
In this final week, students will present their solutionary projects in various formats. Classmates, teachers, additional faculty, families, community members, and other stakeholders who could invest in or help make the solutions happen will be invited to share in the celebration of learning. This week will culminate with a final group discussion to include reviewing the class mind map, teams maps, and learning journals and considering what next steps we can take to make individual and systemic choices that do more good and less harm.

Unit Wrap-up:
After presentations, have students complete the following reflection questionnaire (See Appendix G).
Appendix A:

Question Formulation Technique

Produce Your Questions

Four essential rules for producing your own questions:
- Ask as many questions as you can.
- Do not stop to discuss, judge, or answer the questions.
- Write down every question exactly as it is stated.
- Change any statement into a question.

Improve Your Questions

- Categorize the questions as closed- (yes/no) or open-ended (requires more in-depth response).
- Name the advantages and disadvantages of each type of question.
- Change questions from one type to another.

Prioritize the Questions

- Choose the 3-5 questions that are most important to you.
- Why did you choose these three as the most important?

Next Steps

- How are you going to use your questions?
Appendix B:
Part I. Brainstorm

<table>
<thead>
<tr>
<th>K</th>
<th>What we think we <strong>know</strong> about the system</th>
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<tbody>
<tr>
<td>W</td>
<td>What we <strong>want</strong> to know about the system</td>
</tr>
<tr>
<td>L</td>
<td>What we <strong>learned</strong> about the system</td>
</tr>
</tbody>
</table>
Part II (A.) What we already know, assume, imagine about our system (1-3 paragraphs)

What we already know, assume, imagine:

Part II (B.) What we want to know (5–7 questions/statements)
Develop and answer questions about your topic that you want to learn through your research. Write well thought out questions. These questions will guide your search.

What we want to know:
**Part III. The Search**

Explore and find answers to the following questions/criteria about the system you are researching:

- Briefly describe your system.
- What are the core elements/components of your system?
- How is your system related to the core question (death/dead zone)?
- How does your system affect humans, animals, and the planet?
- How is it connected to ecological systems?
- What other social systems is it connected to and how?

<table>
<thead>
<tr>
<th>Our research:</th>
<th></th>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>
Search Log:
Log your research, dates, notes, sources (minimum of 8 entries). Describe the sequence of steps, summarize information, indicate what was and wasn’t useful, and use this to add to your Works Cited page.

<table>
<thead>
<tr>
<th>Date</th>
<th>Notes/Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
Part III. Interview (1 page)

Conduct an interview with an expert in the system you are studying. Create a set of questions to ask your expert and record her/his responses. Include in your report the expert’s name, job title/position, place of employment, why you chose her/him, the questions you asked, and her/his responses. Also include how the interview confirmed or changed what you already knew about your topic and provide any new insights.
Part IV. What We Learned (1 page)
Record what you learned from your research. In your own words explain, discuss, and describe new concepts and new ideas discovered about your topic.

What we learned:
Part V. Mathematical Model

Based on the data collected, create a mathematical model to demonstrate a relevant piece of data about your system. (A mathematical model is the process of applying mathematics to a real world problem with a view of understanding the problem. If students have never done mathematical modeling before, use resources such as this one, this one, or this one to help guide them.)

For example, if your group is researching:

- the political/government system, you might want to create a model related to the amount of subsidies and promotion certain foods (e.g., corn, soy, animal products, vegetables, fruits) receive in comparison with government nutritional recommendations (such as the My Plate model) about our consumption of those foods.
- the food system, you might want to create a model related to kinds of foods for the school lunch program subsidized by the federal government and their nutritional profile, as well as those foods not subsidized and their nutritional profile.
- the media system, you might want to create a model related to the number, and what kinds of food commercials and ads children are exposed to, by type of media and age of child.
- corporations/industry, you might want to create a model related to the amount of money corporations have donated to legislative candidates, and the percentage of time those legislators voted in ways that benefitted the corporation.
- the health care system, you might want to create a model related to the incidence of diet-related diseases and whether there’s any correlation between the consumption of one or more of these: sugar, animal products, processed foods, etc. or a model about money dedicated to prevention of heart disease, cancer, and diabetes vs. treatment/cure, or a model of nutrition education and prevention courses taught in med school (hours of study) and community health initiatives vs. treatment.
Mathematical Model

Model we’re creating:

Relevant data:

Process/equation(s) for creating the model:

Final model:
Part VI. Conclusion/Reflection (1 page)
Explain in detail what your group learned about the system you researched. Briefly discuss what went well, successes and/or drawbacks encountered in planning and completing research, and how you plan to use what you learned.

Conclusion & Reflection:
Part VI. Works Cited

Use the APA style of formatting to cite sources used for your research. A minimum of five references representing a variety of sources (e.g., books, websites, articles, personal interviews) must be used.

Works Cited:

1.

2.

3.

4.

5.
## Part VII. Rubric

Using the assessment rubric, assess your group on research, system information, I-Search research paper, math model, slideshow and collaboration.

<table>
<thead>
<tr>
<th>Rubric Category</th>
<th>Yes</th>
<th>Partially</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research:</strong></td>
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<td></td>
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</tr>
<tr>
<td>Did you use a wide variety of credible and accurate sources?</td>
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<tr>
<td>Is your research conclusion strongly supported with examples, details, stories, and arguments?</td>
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<tr>
<td><strong>System:</strong></td>
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<tr>
<td>Did you clearly explain your system?</td>
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<tr>
<td>Did you develop a strong and coherent connection between your system and the overarching unit question?</td>
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<tr>
<td><strong>I-Search Research Paper:</strong></td>
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<tr>
<td>Have you included at least two peer-reviewed articles, two books, one Internet source, mathematical model, and an interview?</td>
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<tr>
<td>Have you used correct APA formatting?</td>
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<tr>
<td><strong>Mathematical Model:</strong></td>
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<tr>
<td>Did you develop a coherent and relevant math model to demonstrate a piece of data from your system?</td>
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<tr>
<td><strong>Slideshow:</strong></td>
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<tr>
<td>Did you create and present an inspiring, clear, creative, and relevant slideshow?</td>
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<tr>
<td>Is your slideshow free from spelling and grammatical errors?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presentation:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was your presentation clear and engaging?</td>
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<tr>
<td>Did all members in your group actively participate in the presentation?</td>
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<tr>
<td><strong>Collaboration:</strong></td>
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<tr>
<td>Were the tasks divided and evenly shared?</td>
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<tr>
<td>Was consensus achieved respectfully with all thoughts and ideas considered?</td>
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</tbody>
</table>

Rubric created with inspiration from GCE Lab School
Appendix C:

My belief:__________________________________________________________

1. Why do I believe this?

2. What’s the evidence for my belief?

3. What direct research (e.g., scientific analysis, field work, primary source investigation) have I conducted to ascertain the validity of my belief?

4. How would I feel if my belief were disproven?

5. How deeply connected to my identity is this belief?

6. What are some alternative views?

After completing this exercise, reflect on the process by answering these additional questions:

7. What would it take to truly substantiate my belief?

8. What have I learned about myself and my beliefs from answering these questions?

9. What would it take to become a better critical thinker?

10. How might I help others to become better critical thinkers?
Appendix D:

The T.H.I.N.K. questions ask us to be mindful of our speech by considering:

- Is what I want to say **True**?
- Is what I want to say **Helpful**?
- Am I the best one to say it?
- Is it necessary to say it **Now**?
- Is it **Kind** to this person and others?

~ Dr. Christopher Willard, Mindfulness for Teen Anxiety

For each of the following situations, decide whether the person followed the guidelines for mindful speech:

Mark √ for yes, X for no, or ? if you're not sure.

1. Amahla’s presentation was poorly presented. I told her, “Your presentation was great!”
   
   Did I T.H.I.N.K. before I spoke?  ____T____H____I____N____K

2. As soon as Amahla left the room, I said to my friends, “Amahla’s presentation was terrible, wasn’t it?”
   
   Did I T.H.I.N.K. before I spoke?  ____T____H____I____N____K

3. “I really disagree with your assertions about health care. But I want to better understand why you believe what you do, so please tell me more.”
   
   Did I T.H.I.N.K. before I spoke?  ____T____H____I____N____K
### True Price Template

<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this item more a want or a need for you? What about for people in circumstances different from your own? Should this question matter to us in how we make choices?</td>
<td></td>
</tr>
<tr>
<td>What are the effects of the item on me?</td>
<td></td>
</tr>
<tr>
<td>What are the effects of the item on other people?</td>
<td></td>
</tr>
<tr>
<td>What are the effects of the item on nonhuman animals?</td>
<td></td>
</tr>
<tr>
<td>What are the effects of the item on the environment?</td>
<td></td>
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<tr>
<td>What systems support, promote, rely on, and/or perpetuate this item?</td>
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<tr>
<td>What alternatives would do more good and less harm for all?</td>
<td></td>
</tr>
<tr>
<td>How can we further develop just, peaceful, and sustainable alternatives and systems and make these ubiquitous?</td>
<td></td>
</tr>
<tr>
<td>Sources consulted</td>
<td></td>
</tr>
</tbody>
</table>
Appendix F:

**Design Thinking Brainstorming Template**

<table>
<thead>
<tr>
<th>Dreams/Things I Wish Would Exist:</th>
<th>How might we...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy and high quality food for all students.</td>
<td>How might we design a school cafeteria menu using local, humane, and organic foods?</td>
</tr>
</tbody>
</table>
### Appendix G:

**Reflection Questionnaire**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td></td>
</tr>
<tr>
<td>Unit title:</td>
<td></td>
</tr>
<tr>
<td>Project title:</td>
<td></td>
</tr>
<tr>
<td>What is the most important thing you learned in this unit?</td>
<td></td>
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<tr>
<td>What do you wish you had spent more time on or done differently?</td>
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<tr>
<td>What part of the project did you do your best work on?</td>
<td></td>
</tr>
<tr>
<td>What were the most thought-provoking, useful and meaningful parts of this unit? Of your project?</td>
<td></td>
</tr>
<tr>
<td>What were the least useful and meaningful parts of this unit? Of this project?</td>
<td></td>
</tr>
<tr>
<td>How could your teacher(s) change this unit to make it better next time?</td>
<td></td>
</tr>
<tr>
<td>What solutionary ideas do you have for improving it?</td>
<td></td>
</tr>
<tr>
<td>How has what you learned in this unit influenced your values and personal choices?</td>
<td></td>
</tr>
</tbody>
</table>