

Teacher's Guide

muse[®]

MARCH 2017

The Power of Many

MAGAZINE ARTICLES

- Fairy Circles and Devil's Gardens.10
Expository Nonfiction 1020L
- Communing with the Letter Spirits16
Expository Nonfiction 830L
- Emergency24
Science Fiction 780L
- Reaching Like Roaches30
Expository Nonfiction 940L
- The Race to Discover the Fate of the Universe .36
Expository Nonfiction 1060L

**Why do groups, gaggles,
and friendly rivals achieve
such interesting results?**



Teacher's Guide for *Muse: The Power of Many*

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OVERVIEW

In this magazine, readers will learn about the benefits of collaboration.

Muse: The Power of Many includes articles about hoards of ants who garden

together, swarms of robot cockroaches that may be able to save disaster victims, the spirit of cooperation between rival teams of scientists, and the spirit behind font design. In addition, the magazine includes a science fiction story about one scientist's catastrophic decision.

ESSENTIAL QUESTION:

How does collaboration improve problem solving abilities?



We invite you to use this magazine as a flexible teaching tool, ideal for providing interdisciplinary instruction of social studies and science content as well as core literacy concepts. Find practical advice for teaching individual articles or use a mini-unit that helps your students make cross-text connections as they integrate ideas and information.

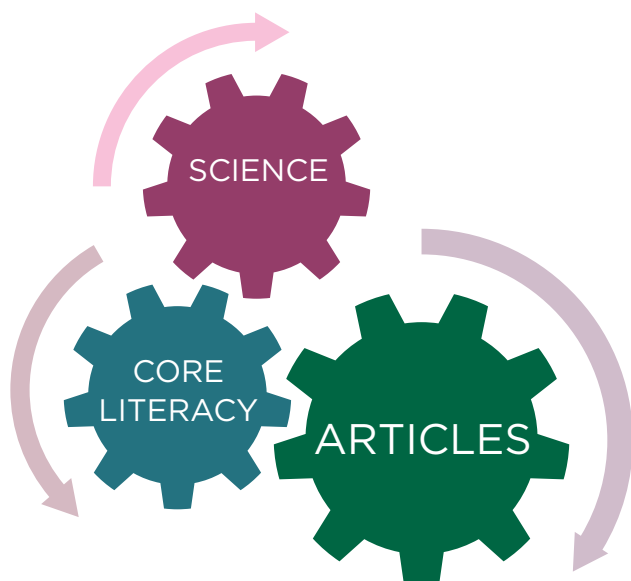
READ INDIVIDUAL ARTICLES PAGES 4 - 8

Each article in this magazine is well-suited for teaching literacy concepts and content area knowledge. For each individual article in this guide, you'll find the following:



TEACH A MINI-UNIT PAGES 10 - 12

Magazine articles can easily be grouped to make cross-text connections and comparisons. Our Mini-Unit allows students to read and discuss multiple articles and integrate ideas and information (CCSS.Reading.9). Discussing multiple articles (CCSS.Reading.9) prepares students to write texts to share and publish in a variety of ways (CCSS.Writing.2).





Essential Question: How does collaboration improve problem solving abilities?

MAGAZINE ARTICLES	CORE CONTENT CONCEPT	LITERACY SKILLS	CORRESPONDING CCSS ANCHOR STANDARDS
Fairy Circles and Devil's Gardens Expository Nonfiction	Cause and effect relationships may be used to predict phenomena in natural systems.	- Close Reading - Analyze Perspectives - Evaluate Evidence - Write a Legend	<i>Reading 1, 2, 6 & 8</i> <i>Writing 3</i>
Communing with the Letter Spirits Expository Nonfiction	The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful.	- Close Reading - Interpret Visual Information - Analyze Text Structure - Write and Present a Speech	<i>Reading 1, 2, 5 & 7</i> <i>Writing 2</i> <i>Speaking & Listening 4</i>
Emergency Science Fiction	Human decisions and activities have had a profound impact on the physical environment.	- Close Reading - Analyze Text Structure - Analyze Point of View - Write a Story	<i>Reading 1, 2, 3, 5 & 6</i> <i>Writing 3</i>
Reaching Like Roaches Expository Nonfiction	Complex structures and systems can be analyzed to determine how they function.	- Close Reading - Evaluate Evidence - Interpret Visual Information - Support an Opinion	<i>Reading 2, 3, 7 & 8</i> <i>Writing 1</i>
The Race to Discover the Fate of the Universe Expository Nonfiction	Explanations of stability and change in natural or designed systems can be constructed by examining changes over time.	- Close Reading - Evaluate Evidence - Interpret Visual Information - Write and Perform a Script	<i>Reading 1, 3, 7 & 8</i> <i>Writing 3</i> <i>Speaking & Listening 1</i>

Comparing Texts: *Reading 9*

Mini-Unit: *Reading 1, 2 & 3; Writing 2; Speaking & Listening 1*





For years, scientists have worked to explain the presence of fairy circles in Africa and Australia and devil's gardens in Peru. Proving a hypothesis about the origins of these mysterious growth patterns has been difficult, but scientists remain hopeful that someday a conclusive answer will be found.

ESSENTIAL QUESTION

How does collaboration improve problem solving abilities?

CORE CONTENT CONCEPT

Science Cause and effect relationships may be used to predict phenomena in natural systems.

CROSS-CURRICULAR EXTENSION

Geography Compare and contrast the geography of Namibia and the Australian Outback. What conclusions can you draw about why fairy circles appear in these places?

KEY VOCABULARY

cultivates (p. 11) grows and cares for plants

supernatural (p. 11) unable to be explained by science or the laws of nature

sapling (p. 12) a young tree

radioactivity (p. 13) the presence of a powerful and dangerous form of energy called radiation

PREPARE TO READ

Locate the countries of Peru and Namibia on a world map. Tell students that phenomena in these two countries have attracted researchers for years. Based on geographic location, ask students to hypothesize obstacles that might prevent scientists from conducting successful experiments in these countries.

CLOSE READING AND TEXT ANALYSIS

Key Ideas

- Locate facts from the text that explain why the lemon ants work together to kill plants and trees. *CCSS Reading 1*
- Use details from the article to summarize Megan Frederickson's devil's garden experiment. What conclusions did she reach? *CCSS Reading 2*
- Why did Walter Tschinkel change his thinking on the connection between fairy circles and termites? Cite text details to support your answer. *CCSS Reading 1*

Craft and Structure

- **Analyze Perspectives** Tschinkel says, "Few [scientists] communicate the missteps, the mishaps, the false steps, the failures." Why does he say this? What ideas about scientific research is he conveying? *CCSS Reading 6*
- **Evaluate Evidence** Do Frederickson's and Tschinkel's research present enough evidence to convince you of the origins of devil's gardens and fairy circles? Explain why or why not. *CCSS Reading 8*

WRITING

Write a Legend How do you like me now: Throughout history, different cultures have created legends to explain mysteries. Write a legend that explains the open areas in the middle of the dense Amazonian rainforest or the polka-dot patterns in the Namib Desert or the Australian outback.

ARTICLE: Communing with the Letter Spirits

Magazine pages 16-19, Expository Nonfiction



Who invents the fonts on a computer and how is a new font designed? Cognitive scientist Douglas Hofstadter takes us back to 1979 to walk us through the process of creating a font. In addition, he explains why humans are still better than computers when it comes to creating fonts.

ESSENTIAL QUESTION

How does collaboration improve problem solving abilities?

CORE CONTENT CONCEPT

Science The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful.

CROSS-CURRICULAR EXTENSION

Computer Applications Computer coders change information into a set of letters, numbers, or symbols that can be read by a computer. How is coding similar to creating fonts? Which would you prefer to do? Share your answers with a classmate.

KEY VOCABULARY

constraint (p. 18) something that limits or restricts someone or something

legible (p. 19) clear enough to be read

PREPARE TO READ

Show students the name of your school printed in several different fonts. Discuss the similarities and differences between the fonts. Then ask students to describe the moods created by the different fonts and how the fonts affect legibility.

CLOSE READING AND TEXT ANALYSIS

Key Ideas

- What is the “spirit” of a font? Cite details from the text to support your response. *CCSS Reading 1*
- Using details from the article, describe the problems Hofstadter ran into while creating his Benzene gridfont and how he solved them. *CCSS Reading 1*
- Identify sentences in the text that summarize what Hofstadter learned about computers and their capabilities. *CCSS Reading 2*

Craft and Structure

- **Analyze Text Structure** Use details from the article to create a timeline of events in the development of fonts. What does Hofstadter suggest computers might be capable of in the future? Add this to the timeline. *CCSS Reading 5*
- **Interpret Visual Information** How do the graphics on pages 18 and 19 help you contemplate the question “what is an ‘a’?” Explain how the graphics aid your understanding of a font spirit. *CCSS Reading 7*

SPEAKING AND LISTENING

Write and Present a Speech Design your own font by using the grid on page 20 of the article. Based on this work, write a short informational speech to explain your font design and the spirit of your font. Include details about your own creative process and how ideas came to you. Display your alphabet as you deliver your speech to your classmates.



A collective system of organisms is attacking resource extraction sites around the world. The harder people fight the organisms, the more aggressive the organisms become. The President consults Professor Loloma to learn about the behavior of the organisms. But it's what the presidential aide discovers that is most surprising.

ESSENTIAL QUESTION

How does collaboration improve problem solving abilities?

CORE CONTENT CONCEPT

Science Human decisions and activities have had a profound impact on the physical environment.

CROSS-CURRICULAR EXTENSION

Art Create a poster based on the story that warns people against the overuse of natural resources. Include information about the organisms and what will happen if people don't conserve resources. Use words and images.

KEY VOCABULARY

pandemic (p. 26) an occurrence in which a disease spreads very quickly and affects a large number of people over a wide area or throughout the world

analogue (p. 26) something that is similar to something else in design, origin, use, etc.

homeostasis (p. 27) the tendency of an organism or environment to remain stable and relatively constant

PREPARE TO READ

Have students brainstorm a list of ways people have learned to conserve natural resources. Lead a discussion on the importance of resource conservation. Ask students to predict what would happen without conservation efforts.

CLOSE READING AND TEXT ANALYSIS

Key Ideas

- Create a list of the words and details the author uses to describe the organisms. What images do these words and details create in your mind? *CCSS Reading 1*
- What conflict exists between the humans and the organisms? Use details from the story to support your response. *CCSS Reading 3*
- What is the theme or message of this story? Support your ideas with details from the story. *CCSS Reading 2*

Craft and Structure

- **Analyze Text Structure** Reread the section of the story on page 28. What important information does it reveal about the professor? What are the aide and the professor thinking and feeling? What is the mood? *CCSS Reading 5*
- **Analyze Point of View** Rewrite a scene from this story using the first-person point of view. Choose the President, the professor, or the president's aide to be the narrator. Include the narrator's thoughts and feelings. *CCSS Reading 6*

WRITING

Write a Story What action will the president's aide take now that he knows about Professor Loloma's secret? What will the professor do? Who will tell the president? Write your own story based on the characters and the situation in "Emergency."

ARTICLE: Reading Like Roaches

Magazine pages 30-33, Expository Nonfiction



Cockroaches are considered pests to many people, but one Harvard researcher spent time studying these pests. What he's learned has implications that could positively impact search and rescue missions worldwide.

ESSENTIAL QUESTION

How does collaboration improve problem solving abilities?

CORE CONTENT CONCEPT

Science Complex structures and systems can be analyzed to determine how they function.

CROSS-CURRICULAR EXTENSION

Geography Conduct research to learn the areas of the world that are prone to earthquakes. Note their locations on a world map. Then study this information and describe any relationships or patterns you notice.

KEY VOCABULARY

nocturnal (p. 30) active mainly during the night

splay (p. 32) to move out and apart from each other

terrain (p. 33) land of a particular kind

PREPARE TO READ

Ask students if they consider mice to be household pests. Encourage students to explain why or why not. Then discuss how and why scientists have used mice in scientific research. Explain that in this article, students will read about a scientist who uses a very unpopular insect in his experiments.

CLOSE READING AND TEXT ANALYSIS

Key Ideas

- How does this article illustrate the benefits of collaboration? Use details from the article to support your response. *CCSS Reading 2*
- Use facts from the article to summarize what Jayaram was trying to learn about cockroaches. *CCSS Reading 2*
- Create a list of cause/effect relationships based on Jayaram's experiments. Cite details from the article to support your response. *CCSS Reading 3*

Craft and Structure

- **Interpret Visual Information** How might CRAM be able to make its way through a structure like the one shown on page 32? *CCSS Reading 7*
- **Evaluate Evidence** Did Jayaram conduct enough experiments with enough variables to learn what he needed to know before constructing CRAM? What additional experiments might he need to conduct before mass-producing these robots for search and rescue missions? *CCSS Reading 8*

WRITING

Support an Opinion How do you feel about the use of animals in scientific research experiments? State your opinion and support it with facts and details mentioned in this article, personal experience, and additional outside sources. Share your work with classmates.

ARTICLE: The Race to Discover the Fate of the Universe

Magazine pages 36-43, Expository Nonfiction



What is the fate of the universe? This is the question two teams of scientists raced to answer in the 1990s. A friendly rivalry between astronomers and physicists led to a startling conclusion that neither team anticipated.

ESSENTIAL QUESTION

How does collaboration improve problem solving abilities?

CORE CONTENT CONCEPT

Science Explanations of stability and change in natural or designed systems can be constructed by examining changes over time.

CROSS-CURRICULAR EXTENSION

Geography What geographic conditions make Hawaii and Chile good choices for observatories? Conduct online research to answer this question. Share what you learn with classmates.

KEY VOCABULARY

emit (p. 39) to send light, energy, etc., out from a source

light year (p. 39) a unit of distance equal to the distance that light travels in one year (about 5.88 trillion miles or 9.46 trillion kilometers)

skepticism (p. 40) an attitude of doubting the truth of something

novice (p. 41) a person who has just started learning or doing something

PREPARE TO READ

Ask students to define a rivalry (a situation in which people or groups are competing with each other). Help students brainstorm examples of rivalries. Then lead the class in a discussion about the positive and negative effects of rivalries.

CLOSE READING AND TEXT ANALYSIS

Key Ideas

- How did the rivalry between astronomers and physicists benefit both teams? Support your response with details from the article. *CCSS Reading 1*
- Use facts in the article to compare the teams, their members, their goals, and their methods. Record your ideas in a Venn diagram (p. 14). *CCSS Reading 3*
- How might future teams of research rivals be inspired by the scientists in this story? Support your response with details from the article. *CCSS Reading 1*

Craft and Structure

- Interpret Visual Information** How do the visuals on pages 38-39 help you understand the concept of “standard candles”? How do they help explain the expansion of the universe over time? *CCSS Reading 7*
- Evaluate Evidence** The teams shared a Nobel Prize. What were the contributions of each team? Is this evidence sufficient to convince you that both teams deserved the award? Explain why or why not. *CCSS Reading 8*

SPEAKING AND LISTENING

Write and Perform a Movie Scene Work with a partner to write a movie script based on a scene from the article. For example, you might write about Adam Riess being razzed by the SCP or Alex Filippenko leaving the SCP to join the astronomers. In addition to dialogue, include information about gestures, movements, facial expressions, and tone of voice. Ask classmates to perform your scene.



CROSS-TEXT CONNECTIONS

SYNTHESIZE: Guide students to compare articles they read. Help students find the connections between pieces of information in multiple articles. Use prompts, such as the following examples, to have students work together to **Integrate Ideas and Information** (CCSS.Reading.9).

- The nonfiction articles you read describe a number of specific researchers and scientists. How are these individuals similar? Generate a list of their common characteristics and traits. Then use this information to write a description of what it takes to be a good scientist.
- “Emergency” is a work of fiction in which a scientist uses her knowledge to secretly create a new problem that she believes will solve an existing problem. Is this the right thing to do? Explore the responsibilities scientists have to each other and to the general population. Use information from “Reaching Like Roaches,” “Emergency,” and one other article to write a Code of Ethics for scientists.
- Use information from two of the nonfiction articles to answer the Essential Question: How does collaboration improve problem solving abilities? Do you think the story “Emergency” provides good examples of using collaboration to solve problems? Explain why or why not.
- Reread “Reaching Like Roaches” and “Fairy Circles and Devil’s Gardens” to locate sections of text emphasizing adaptation. How is adaptation necessary to survival? What can humans learn from these examples of adaptation? Write your observations in the style of a field notebook complete with sketches.
- Gather information from across texts identifying the contributions of specific people mentioned throughout this issue. Then imagine you are creating an encyclopedia of famous scientists. Write entries for three of the people you’ve read about.



EXPLORATORY LEARNING - FLEXIBLE MINI-UNIT DESIGN

ENGAGE

READ FOR A PURPOSE

APPLY

In this mini-unit, students will work in groups to create posters. Each poster will use information from the magazine or other sources to convey the benefits of collaboration. The individual posters will be combined to create a class mural with the theme “the power of many.”

ENGAGE: Engage students in the topic of working collaboratively by first reviewing the **Essential Question: How does collaboration improve problem solving abilities?** Then work with students to complete the graphic organizer below by discussing the different benefits of working collaboratively in each of the situations listed. Sample text is shown for the first situation.

	Social Benefits 	Emotional Benefits 	Logistical Benefits 
Situation: a large homework project	Students can brainstorm ideas and discuss problems.	Students bond with other group members by sharing an experience.	Group members can break off into pairs to work on different parts of the project at the same time.
Situation: a school fundraiser			
Situation: a science experiment			

**READ FOR A PURPOSE**

INTRODUCE THE ACTIVITY: THE POWER OF MANY MURAL Explain to students that for the culminating activity of this mini-unit, they will work in groups to create a classroom mural that illustrates the theme “the power of many.” Continue by explaining that each group will create an individual poster and these posters will be joined to create the mural. Make sure students understand that the individual posters may include, among other things:

- drawings and illustrations
- diagrams
- written information
- quotes from the articles

RETURN TO THE TEXT: Before students can begin working on the class mural, they first must gather information about what can be achieved through working collaboratively. Distribute the “Power of Many” graphic organizer (p. 13). Tell students to choose two feature articles from the magazine to reread and analyze, using the graphic organizer.

When students have finished this activity, invite them to share the information they discovered and recorded. Then divide the class into small groups to work on the posters.





APPLY: THE POWER OF MANY MURAL Now that students have gathered information from the articles, they are ready to work with their groups to create posters. Reserve a wall or bulletin board in your classroom for the mural and attach the title “The Power of Many” to it.

Materials

- poster board or large pieces of drawing paper, one per group
- completed “Power of Many” graphic organizer
- colored pencils and magic markers

STEP 1: Build Background Remind students that they will be working in groups to create one section of a class mural focused on the theme “the power of many.” Continue by explaining that groups may use ideas from this issue of *Muse* or their own ideas to convey the benefits of working collaboratively. Display these guidelines and tell students to use them to help them harness the power of many as they work together:

- Define individual roles and tasks for group members (note-taker, for example).
- Solve problems and make decisions collaboratively.
- Listen to each other.

STEP 2: Brainstorm Allow groups time to brainstorm ideas for their posters. Remind them that they can use words, pictures, diagrams, and anything else they can think of to help convey their ideas.

STEP 3: Draft Tell groups to use scrap paper or the reverse sides of their graphic organizers to sketch mural design ideas. Suggest group members work individually to come up with a few ideas and then reconvene to go over all ideas, generate more ideas if necessary, and then choose the ones they will use.

STEP 4: Create Posters Distribute drawing paper or poster board to groups and make colored pencils and markers available to all. Suggest that students first use pencil to put their words and pictures on paper and then go over this with pen or marker.

STEP 5: Assemble Work with students to assemble the mural on the designated wall or bulletin board in the classroom. When all sections are on display, help students visually connect the sections into a single mural by, for example, drawing lines or using a long piece of yarn to tie them together.

STEP 6: Present and Discuss Allow groups to present their sections of the mural and explain how they worked collaboratively to create it. Then discuss whether the mural successfully conveys the theme. Finally, ask students what they learned about working collaboratively.



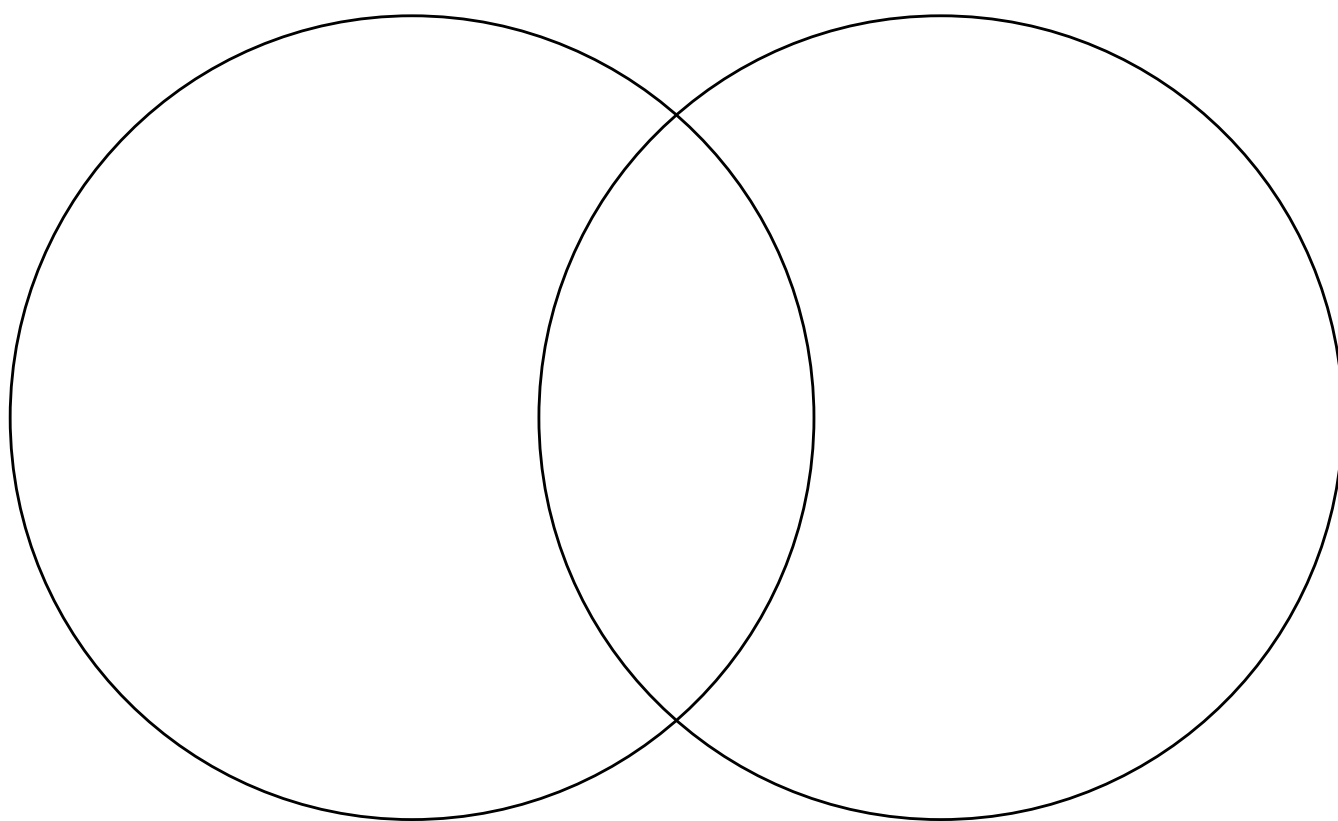
NAME: _____

THE POWER OF MANY

	Article Title:	Article Title:
Who or what worked in a group?		
What did this group achieve?		
How did working in a group help them reach these results?		
Could an individual also achieve these results? Why or why not?		
Quotes and details from the article		

NAME: _____

VENN DIAGRAM





Meeting State and National Standards: Core Instructional Concepts

The articles in this magazine provide a wealth of opportunities for meeting state and national instructional standards. The following pages contain charts listing Core Instructional Concepts for each of three curricular areas: English Language Arts, Science, and Social Studies.

USING THE STANDARDS CHARTS

ELA

Corresponding CCSS anchor standards have been listed next to each item on the Core Instructional Concepts chart. To customize the chart, add your own grade, state, or district standards in the last column. Match the concepts and standards from the chart to the activities on each page of the Teacher's Guide to complete your lesson plans.

SOCIAL STUDIES

Content Concepts in each Article Guide are based on Dimension 2 of the CS Framework for Social Studies: Applying Disciplinary Concepts and Tools. Use the last column in the accompanying chart to correlate these concepts to your state or district standards.

SCIENCE

Content Concepts in each Article Guide are drawn from the Three Dimensions of the Next Generation Science Standards. You will also find connections to these concepts within individual close-reading questions.

MATH

Content Opportunities for math activities are provided in the Cross-Curricular extensions on each Article Guide page.

CORE INSTRUCTIONAL CONCEPTS: READING, LITERATURE, AND LANGUAGE ARTS

SKILLS AND CONCEPTS	CCSS ANCHOR STANDARD	CORRESPONDING STANDARD
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KEY IDEAS AND DETAILS

Read closely to determine what a text says explicitly.	Reading 1	
Make logical inferences to determine what the text communicates implicitly.	Reading 1	
Cite specific textual evidence to support conclusions drawn from the text.	Reading 1	
Determine central ideas or themes of a text and analyze their development.	Reading 2	
Summarize key supporting details and ideas.	Reading 2	
Analyze how individuals, events, and ideas develop and interact over the course of a text.	Reading 3	

CRAFT AND STRUCTURE

Interpret words and phrases as they are used in a text.	Reading 4	
Determine technical, connotative, and figurative meanings.	Reading 4	
Analyze how specific word choices shape meaning or tone.	Reading 4	
Analyze the structure of texts (sequence, cause/effect, compare/contrast, problem/solution)	Reading 5	
Recognize the genre, key elements, and characteristics of literary texts.	Reading 5	
Assess how point of view or purpose shapes the content and style of a text.	Reading 6	
Analyze how an author's style and tone affects meaning.	Reading 6	

INTEGRATION OF KNOWLEDGE AND IDEAS

Integrate and evaluate content presented in diverse media and formats.	Reading 7	
Identify and evaluate the argument and claims in a text.	Reading 8	
Analyze how two or more texts address similar themes or topics.	Reading 9	

WRITING

Write arguments to support claims, using valid reasoning and relevant and sufficient evidence.	Writing 1	
Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately.	Writing 2	
Write narratives to develop real or imagined experiences or events.	Writing 3	
Draw evidence from literary or informational texts to support analysis, reflection, and research.	Writing 9	
Conduct short as well as more sustained research projects.	Writing 10	



CORE INSTRUCTIONAL CONCEPTS: SOCIAL STUDIES

C3 INQUIRY ARC DIMENSION 2: APPLYING DISCIPLINARY CONCEPTS AND TOOLS

STATE OR DISTRICT STANDARD

CIVICS

Analyze the origins, functions, and structure of different governments and the origins and purposes of laws and key constitutional provisions.	
Summarize core civic virtues and democratic principles .	
Evaluate policies intended to address social issues.	

ECONOMICS

Evaluate the benefits and costs of individual economic choices .	
Analyze economic incentives , including those that cause people and businesses to specialize and trade.	
Explain the importance of resources (i.e. labor, human capital, physical capital, natural resources) in methods of economic production .	
Explain the functions of money in a market economy.	
Explain the importance of competition in a market economy.	
Apply economic concepts (i.e. interest rate, inflation, supply and demand) and theories of how individual and government actions affect the production of goods and services .	
Analyze economic patterns , including activity and interactions between and within nations.	

GEOGRAPHY

Construct and use maps and other graphic representations (i.e. images, photographs, etc.) of different places.	
Explain cultural influences on the way people live and modify and adapt to their environments.	
Analyze places, including their physical, cultural and environmental characteristics and how they change over time.	
Analyze movement of people, goods, and ideas .	
Analyze regions, including how they relate to one another and the world as a whole from a political, economic, historical, and geographic perspective.	

HISTORY

Interpret historical context to understand relationships among historical events or developments .	
Evaluate historical events and developments to identify them as examples of historical change and/or continuity .	
Analyze perspectives , including factors that influence why and how individuals and groups develop different ones.	
Evaluate historical sources , including their reliability, relevancy, utility, and limitations.	
Analyze causes and effects , both intended and unintended, of historical developments.	

CORE INSTRUCTIONAL CONCEPTS: SCIENCE

DIMENSION 1: SCIENTIFIC AND ENGINEERING PRACTICES

Dimension 1 focuses on the practice of science, and how knowledge is continually adapted based on new findings. The eight practices of the K-12 Science and Engineering Curriculum are as follows:

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

DIMENSION 2: CROSSCUTTING CONCEPTS

Dimension 2 provides an organizational schema for integrating and interrelating knowledge from different science domains. The eight NGSS Crosscutting Concepts are as follows:

- Patterns
- Similarity and Diversity
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

DIMENSION 3: DIMENSIONS AND DISCIPLINARY CORE IDEAS

Dimension 3 presents a contained set of Disciplinary Core Ideas to support deeper understanding and application of content. The following chart details Core Ideas for curriculum, instructional content, and assessments within four domains.

LIFE SCIENCE	PHYSICAL SCIENCE	EARTH SCIENCE	SPACE SYSTEMS
• Structure and Function of Living Things • Life Cycles and Stages • Reproduction & Inherited Traits • Animals • Plants	• Forces and Interactions • Energy • Light • Sound • Electricity/Magnetism • Matter • Waves • Heat • Chemistry • Information Processing	• Weather • Climate • Rocks & Soil • Erosion and Weathering • Landforms • Water • Oceans • History of Earth • Plate Tectonics • Volcanoes, Earthquakes, and Tsunamis	• Solar System • Planets • Moon • Sun

