Top Secret

Ciphers and codes have been used for thousands of years to send sensitive information back and forth between people. This issue of MUSE explores the historical use of secret messages and examines secure methods for making and breaking codes.

CONVERSATION QUESTION

How are secret messages decoded?

TEACHING OBJECTIVES

- Students will learn about the use of secret messages throughout history.
- Students will learn about one of the greatest codebreakers in history.
- Students will learn why scientific codebreakers are closely examining the khipu of the Inca.
- Students will compare and contrast methods of transmitting secret messages.
- Students will analyze problem-and-solution relationships.
- Students will collect evidence to support a claim.
- Students will represent the opposing powers of WW I on a world map.
- Students will create a timeline chronicling the life of a famous woman in history.
- Students will convert metric measurements.

In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

SELECTIONS

- **Secret Writing Revealed**
  Expository Nonfiction, ~1000L
- **Codebreaker**
  Expository Nonfiction, ~990L
- **Knot Forgotten**
  Expository Nonfiction, ~1020L

Secret Writing Revealed

pp. 10–14, Expository Nonfiction

From tattooed scalps to modern computers, the secret world of codes and ciphers was born of intrigue and war. Readers will learn how secret messages are part of our past and our present.

Lexile Score: ~1000L

RESOURCES

- Compare and Contrast: Message Received

OBJECTIVES

- Students will learn about the use of secret messages throughout history.
- Students will compare and contrast methods of transmitting secret messages.
- Students will represent the opposing powers of WW I on a world map.

KEY VOCABULARY

- *steganography* **(p. 12)** the technique of hiding a secret message or image in a digital file or a physical object that is not secret
- *cryptography* **(p. 12)** the process of encoding and decoding secret messages

ENGAGE

Conversation Question: How are secret messages decoded?

To create interest in the topic, have students turn to page 13 of "Secret Writing Revealed." Discuss the Caesar shift cipher at the top of the page and give students three minutes to decode Top Secret Message #2. Ask a volunteer to reveal the decoded message. Then have students write their first and last names using the cipher alphabet.

INTRODUCE VOCABULARY

Post and read aloud the vocabulary words. Tell students that many scientific terms have Greek or Latin roots. Break apart the terms and show the root meanings. Then compare to actual definitions.

stegano = concealed / **graphy** = write

crypto = secret / **graphy** = write

Ask: "How does knowing the meaning of word roots help you understand the meaning of unfamiliar words?"

READ & DISCUSS

Pose the following questions to prompt meaningful discussion. Students should use complete sentences and details to answer each question.

1. What personality traits and skills do secret agents possess?
2. How did the Greek ruler Histiaeus hide messages?
3. Explain two different kinds of invisible ink.
4. Why did Britain have a secret agent infiltrate the Mexican telegraph office during WW I?
5. How have computers assisted humans with the making and breaking of codes?

SKILL FOCUS: Compare and Contrast

INSTRUCT: Students will compare three message transmission techniques of the past with three present methods. Instruct pairs of students to revisit the text and underline information that will be helpful for this purpose. Introduce the *Compare and Contrast: Message Received* graphic organizer and have partners record the data on the chart. Allow students to use resources to explain current methods in the second column if necessary.

ASSESS: Reconvene and review the graphic organizer with the class. Have students share their answers to the Think Tank question.

EXTEND

Geography Give students a brief overview of WW I by explaining that the war was fought between the Central Powers (mainly Germany and Austria-Hungary) and the Allied Powers (mainly Great Britain, France, and the Russian Empire). Next, distribute copies of a world map. Have students use two different colors to shade the Central and Allied powers and create a map key. Then have students conduct research to identify other countries that were part of the Central and Allied powers and color in these countries.

Message Received

Compare and Contrast Use information from the article to compare/contrast past and present secret message transmission techniques. Use details to explain the methods and then answer the question in the Think Tank.
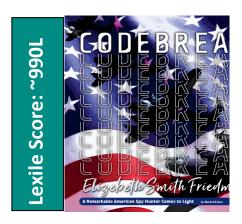
Past	Present
1. 2. 3.	1. 2. 3.

Think Tank: How are the past and present techniques listed above similar to each other? How are they different? Discuss with a partner.

Codebreaker

pp. 22–25, Expository Nonfiction

This article will introduce students to Elizebeth Smith Friedman, an American codebreaker who deciphered enemy codes in both world wars and made important contributions to cryptology.

Lexile Score: ~990L

RESOURCES

- Problem and Solutions: Secret Solutions

OBJECTIVES

- Students will learn about one of the greatest codebreakers in history.
- Students will analyze problem and solution relationships.
- Students will create a timeline chronicling the life of a famous woman in history.

KEY VOCABULARY

- *intercepted* **(p. 23)** to stop and take someone or something that is going from one place to another place before that person or thing gets there
- *intuitive* **(p. 23)** having the natural ability to know or understand things without any proof or evidence
- *encrypted* **(p. 24)** changed information from one form to another to hide its meaning

ENGAGE

Conversation Question: How are secret messages decoded?

Ask students why some people seem to become better known after their death. List responses on the board, then pose this question: *How do you think it feels to live a life in which none of your accomplishments are recognized?* Encourage discussion. Then tell students they will read about such a person in the article "Codebreaker."

INTRODUCE VOCABULARY

Post and discuss the key vocabulary words and definitions. Then display the sentences below and have students supply the correct word. Finally, have students underline the key vocabulary in the article.

1. My dad is an _____ cook, and he hardly ever follows a recipe.
2. Personal information on a computer should be _____ for safety.
3. My sister ___ the cookies my friend was bringing and ate them all.

READ & DISCUSS

Reinforce comprehension of the concepts presented in the article by using the following questions to direct discussion.

1. How did the Germans know the locations of the British and American ships?
2. Why was Elizebeth Smith Friedman such a successful codebreaker?
3. What did billionaire George Fabyan originally hire Friedman to do?
4. Why was "the Doll Lady" arrested?
5. Why did Friedman's accomplishments remain hidden until 2008?

SKILL FOCUS: Problem and Solutions

INSTRUCT: Inform students that they will be rereading the article with a partner and highlighting passages that depict how Elizebeth Smith Friedman solved many of the United States' security problems using her amazing codebreaking abilities. Distribute copies of the *Problem and Solutions: Secret Solutions* graphic organizer. Tell students they will be responsible for recording and explaining the solutions.

ASSESS: Collect the graphic organizers to evaluate students' ability to clearly identify the problem and solutions. Meet with a small group to make corrections if necessary.

EXTEND

History As a class activity, work with the students to create a timeline chronicling the life and achievements of Elizebeth Smith Friedman using information from the article. Demonstrate how to properly set up the timeline from 1890 to 1980 and place and label events along the line. Then have students choose a famous woman in history and complete the necessary amount of research to create their own timelines. Students should find at least two noteworthy events for each decade. Distribute sentence strips (or any suitable paper). Remind the class to create an easy-to-read, appealing finished project.
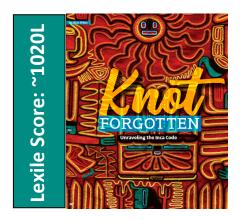
Secret Solutions

Problem and Solutions Use the boxes below to explain how Elizebeth Smith Friedman solved problems that were threatening American security. Provide details.

Problem: Germans knew the locations of American and British ships.

Problem: Smugglers were transporting alcohol illegally into the United States.

Codebreaker

Elizebeth Smith Friedman

Problem: There was a shortage of cryptologists, and the US did not have any decryption agencies.

Problem: Germany created the Enigma device, which could generate billions of different codes.

Knot Forgotten

pp. 30–33, Expository Nonfiction

Using modern computers, memories from Inca descendants, and traditional detective work, codebreakers are attempting to unravel the Inca code. Readers will learn how the ancient civilization may have used knotted strings to communicate.

Lexile Score: ~1020L

RESOURCES

- Collecting Evidence: To Be or "Knot" to Be

OBJECTIVES

- Students will learn why scientific codebreakers are closely examining the khipu of the Inca.
- Students will collect evidence to support a claim.
- Students convert metric measurements.

KEY VOCABULARY

- **intricately (p. 31)** in a way that has many complicated details
- **signifies (p. 32)** means or indicates

ENGAGE

Conversation Question: How are secret messages decoded?

Display the title page of the article "Knot Forgotten." Ask students what they notice about the spelling of the first word. Review the definition of a homophone (a word that sounds the same as another word but has a different meaning and spelling). Why might the author have used *knot* instead of *not*? What word in the subtitle is another clue to the article's content? (Answer: *Unraveling*)

INTRODUCE VOCABULARY

Post the key terms and discuss the definitions. Then display the following questions and have students supply the correct answers.

1. *Which item is the most **intricately** designed?*

a) a pair of scissors b) a paper plate c) a human body d) a candle

2. *Which action **signifies** disapproval?*

a) nodding your head b) giving thumbs up c) shaking hands d) frowning

Share answers aloud and have students explain their reasoning.

READ & DISCUSS

Read the article aloud with the class. Have students reread the article in small groups to answer the questions below. Share responses.

1. Identify some of the accomplishments of the ancient Inca.
2. Why are khipu sometimes referred to as "talking knots"?
3. How were Inca rulers kept well informed?
4. What happened to the khipus as a result of the Spanish conquering of the Inca empire in the 1530s?
5. How might unraveling the ancient Inca Code benefit people today?

SKILL FOCUS: Collect Evidence

INSTRUCT: This article presents the reader with information about the Inca civilization and its ancient form of communication. Present the *Collecting Evidence: To Be or "Knot" to Be* graphic organizer. Tell students they will be reviewing the article and highlighting sentences that provide evidence to support each of the claims stated. After they have collected evidence addressing all of the statements, they will record the information on the organizer. Remind students to cite information and details using page numbers.

ASSESS: Have mini-conversations as students are working. Collect worksheets.

EXTEND

Mathematics Point out that on page 31 the article uses metric measurements to describe the ancient Inca empire. Have students convert each measurement below from kilometers to meters. (× 1000)

Size of empire: 4,023 kilometers = _____ meters

Length of highway: 40,233 kilometers = _____ meters

City on mountain: 2.4 kilometers above sea level = _____ meters

To Be or "Knot" to Be

Collecting Evidence Gather evidence from the text to support each claim. Include details and cite your findings by using page numbers.

Claim: We know the knots on most khipu strings record numbers.
Supporting evidence (P._____)
Claim: The Inca civilization generated vast amounts of data that it needed to keep track of.
Supporting evidence (P._____)
Claim: Even tiny variations among different knots and string can reveal important new knowledge.
Supporting evidence (P._____)