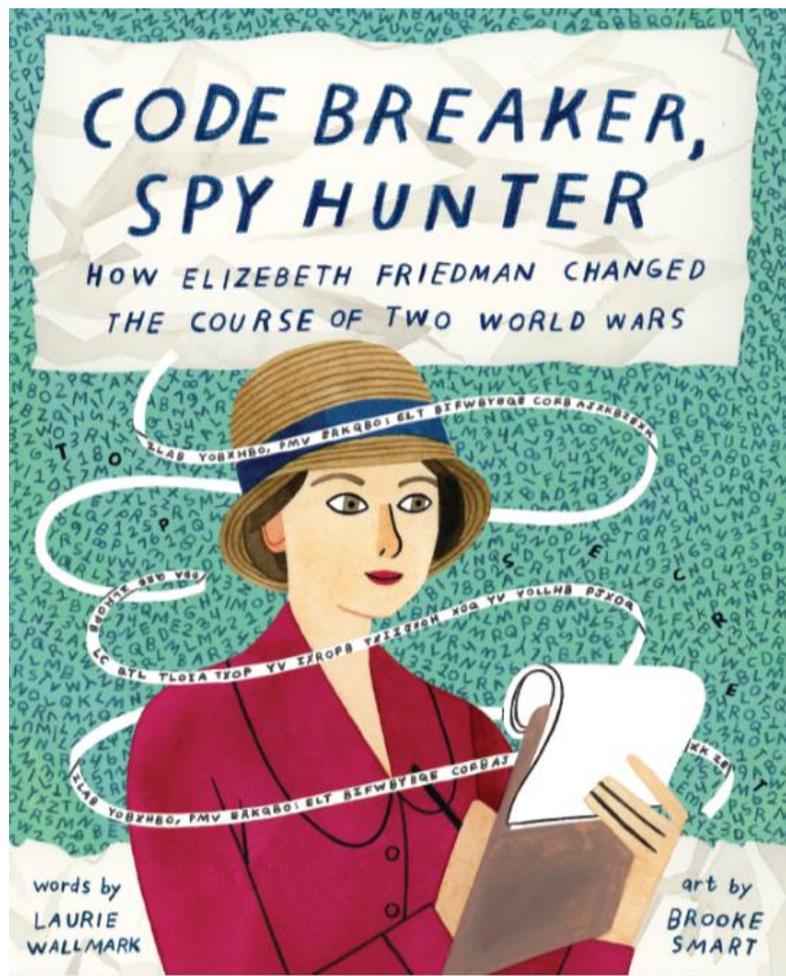


Code Breaker, Spy Hunter

How Elizebeth Friedman Changed the Course of Two World Wars

A teacher's guide created by Marcie Colleen
based upon the picture book biography
written by Laurie Wallmark and illustrated by Brooke Smart



Published by Abrams Books for Young Readers

Laurie Wallmark

Author, *Code Breaker, Spy Hunter*

Award-winning author Laurie Wallmark writes picture book biographies of women in STEM (science, technology, engineering, and math). Her books have earned multiple starred trade reviews, been chosen as Junior Library Guild Selections, and received awards such as Outstanding Science Trade Book, Best STEM Book, Crystal Kite Award, Cook Prize Honor, and Parents' Choice Gold Medal. Her titles include *Ada Byron Lovelace and the Thinking Machine*, *Grace Hopper: Queen of Computer Code*, *Hedy Lamarr's Double Life*, *Numbers in Motion*, and the upcoming *Code Breaker, Spy Hunter*. Laurie has an MFA in Writing from VCFA and frequently presents at schools as well as national professional conferences (NSTA, NCTE, ALA, TLA, etc.). She is a former software engineer and computer science professor. You can find Laurie on the Web at www.lauriewallmark.com and @lauriewallmark.

Brooke Smart

Illustrator, *Code Breaker, Spy Hunter*

Brooke Smart loves telling stories through her illustrations, especially stories about brave women from history. She has always loved to read—as a child, she could be found nightly falling asleep with a book on her chest. Her favorite books from childhood remain among her greatest treasures. Illustrating books as a professional artist is a lifelong dream come true. Working almost always with a brush in her hand, Brooke's images are created using traditional media, such as watercolor, gouache, and occasionally acrylic paint. Brooke is living the busy, tired, happy, wonderful dream in Salt Lake City, Utah, with her husband, their three kids, and their naughty cat named Sunshine.

Marcie Colleen

Curriculum Writer

This guide was created by Marcie Colleen, a former teacher with a BA in English Education from Oswego State and a MA in Educational Theater from NYU. In addition to creating curriculum guides for children's books, Marcie can often be found writing books of her own at home in San Diego, California. Visit her at www.thisismarciecolleen.com.

How to Use This Guide

This classroom guide for *Code Breaker, Spy Hunter* is designed for students in first through fifth grade. It is assumed that teachers will adapt each activity to fit the needs and abilities of their own students.

It offers activities to help teachers integrate *Code Breaker, Spy Hunter* into English language arts (ELA), mathematics, science, and social studies curricula.

All activities were created in conjunction with relevant content standards in ELA, math, science, social studies, art, and drama.

Aligned for Grades 1-5 in both Common Core ELA and Math

- 1st grade: CCSS: ELA.RL.1.1,2,3,5,7; RI.1.1,2,3,4,6,7,8,9; W.1.2,3; SL.1.1,2; L.1.1,2,4; MATH: 1.OA.3, 1.MD.4
- 2nd grade: CCSS: ELA.RL.2.1,3,5,6,7; RI.2.1,2,3,4,6,8,9; W.2.1,2,3; SL.2.1,2,5; L.2.1,2,3,4; MATH: 2.OA.1
- 3rd grade: CCSS: ELA.RL.3.1,3,4,7; RI.3.1,2,3,4,6,7; W.3.1,2,3,4,7,8; SL.3.1,2,3,4,5; L.3.1,2,3,4; MATH: 3.OA.1,3; MD.2
- 4th grade: CCSS: ELA.RL.4.1,2,3,4,6; RI.4.1,2,3,4; W.4.1,2,3,4,7; SL.4.1,2,5; L.4.1,2,3,4; MATH: 4.OA.1,5
- 5th grade: CCSS: ELA.RL.5.1,2,3,4,6; RI.5.1,2,3,4; W.5.1,2,3,4,7; SL.5.1,2,5; L.5.1,2,3,4; MATH: 5.OA.1,5

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English Language Arts

Reading Comprehension

Before reading *Code Breaker, Spy Hunter*

Look closely at the front cover.

- Describe what you see.
- Who do you think the woman is?
- When do you think this story takes place? Today or a long time ago? What clues on the cover tell you this?
- Can you guess what the story might be about? What are some clues that tell you the setting?
- Can you find a secret message on the front cover? What is it?

Now read or listen to the book.

Help students summarize in their own words what the book was about.

- Why did the FBI need Elizebeth Friedman's help?
- What is a cryptanalyst?
- What was the connection Elizebeth found with poetry and coded messages?
- Describe George Fabyan in FIVE words.
 - Why did the librarian at Newberry Library refer Elizebeth to George Fabyan?
 - What did George Fabyan hire Elizebeth Friedman to do?
 - What did Elizebeth's research find?
- What was the Riverbank Department of Ciphers?
 - What did Elizebeth and William do there?
- Why did Elizebeth and William move to Washington DC?
- The United States Army's code making machines were huge and could only be used in a large office building. Why was this a problem?
 - How did Elizebeth and William solve this problem?
- Elizebeth never forgot her love of literature. Describe some of the books she wrote when she was not cracking or making codes.
- Why did the Coast Guard need Elizebeth to come out of retirement?
- Explain in your own words how Elizebeth was able to prove in court that her decodes were science?
- The Coast Guard had too much work for one person to decode, so what did Elizebeth do?
- What are some activities Elizebeth enjoyed outside of work?

- Explain in your own words what the OSS is and what work Elizebeth did for them.
- Once Elizebeth cracked the code for the OSS and learned that these were Nazi messages, why do you think she wanted to wait to raid?
 - Why might the FBI director want to raid right away?
 - Would you have sided with Elizebeth or the FBI director? Explain your answer.
- Why did the United States Postal Service need Elizebeth's help?
- Define "open code" in your own words.
- What was ENIGMA?
 - Why were the ENIGMA codes so difficult to break?
 - Why was it important to crack ENIGMA's codes?
 - How were Elizebeth and her team finally able to crack ENIGMA'S codes?
- Why did the government classify Elizebeth's work as Top Secret Ultra?
- Do you think Elizebeth was a heroine? Why or why not? Explain your answer using specific examples from the book.

Let's talk about the people who created *Code Breaker, Spy Hunter*.

- Who is the author?
- Who is the illustrator?
- What kind of work did each person do to make the book?

Now, let's look closely at the illustrations.

Can you find:

- A copy of *Romeo and Juliet*
- Several pencils
- Five white chickens
- An indoor beehive
- A windmill
- The White House
- Green Mansion
- A duck on wheels
- A chalkboard
- A curious squirrel
- A dinner invitation
- Top secret files
- A picnic basket

Reading Nonfiction

While reading *Code Breaker, Spy Hunter* aloud to the class, have students take notes in two columns:

- *Things We Learned*
- *Questions We Have*

Pause before each page turn to add notes to the columns. These columns can either be individual or put on the smartboard and worked on as a class.

Things We Learned (Facts)	Questions We Have	Answers We Found

- Once the story is read, discuss the *Questions We Have* column.
 - Were any of these questions answered as the story went along?
 - If so, ask students to find the answer within the text.
 - Record the answer next to the question in a third column labelled *Answers We Found*.
- For all remaining questions in the *Questions We Have* column, that have yet to be answered, students will need to take the steps to find answers, either through Internet or book research.
 - See if the back matter contains the answer.
 - Discuss how to find answers to questions through research.
 - Assign students to specific questions to help them focus.
 - Record all answers in the *Answers We Found* column.
- After the answers have been shared with the class, engage in a discussion on research practices.
 - What was the most difficult part about finding answers?
 - Was it easier to find answers on the Internet or in a book?
 - Which source is more reliable, the Internet or a printed book? Why?
 - How can you determine whether to trust a source?
 - What tips would you give someone who is about to do research?
- Read the information, including timelines, at the back of the book.

- Create an additional chart to document what information in the back matter was included in the story and what information was not included.
- Why do you think Laurie Wallmark chose to include certain information and leave other information to the back matter?
- Choose three facts from the back matter and explain why you think each was not included in the story.

Extension: Design and illustrate posters representing each Fact, Question, and researched Answer based on *Code Breaker, Spy Hunter* and display them within the classroom.

Writing Activities

Messages from Elizebeth

Laurie Wallmark included several of Elizebeth Friedman’s quotes throughout *Code Breaker, Spy Hunter*.

Have students choose one of Elizebeth’s quotes and write a four-paragraph essay about what this quote means to them.

Language Activities

De-Ciphering Vocabulary

Code Breaker, Spy Hunter contains many words which may be new for students. Encourage them to use context clues from both the text and illustrations to infer meanings.

cryptanalyst	reputation	spies	evidence	literature
eccentric	peculiar	suspicious	decode	ciphers
prohibition	bootleg	smugglers	rumrunners	backlogged
convict	patriotically	recognition	transmissions	declassified

Additional Exploration:

- While they read, ask students to look carefully for words they do not know. As soon as they come across a new vocabulary word, they should jot it down.
- Look up the unknown word in the dictionary. (Depending on the level of your students, a student volunteer can do this or the teacher can.) Read the definition.

- Come up with a way to remember what the word means. Students can create an action that symbolizes the word and helps them remember it.

Math

Create a Secret Communication Code

Elizebeth Friedman used her knowledge of codes and patterns to crack secret messages sent during World War I and II. Now students can create their own secret communications.

With a lined sheet of paper, create two columns with a long vertical line. In one column write the letters A-Z, one letter per line.

Then in the other column, write different letters. The letters should not be in any particular order, but each letter can only be used once. Each one of these letters will correspond with a letter in the first column.

For example:

#1	#2
A	G
B	W
C	T
D	Q
E	Y
F	B
G	A
H	M

Duplicate the list and give it to your friends.

Write a secret note using the letters in column two to represent the letters in column one.

Students will be able to “decode” and translate your message by using the letter key.

Math Without Numbers

Elizebeth Friedman and other cryptanalysts use math skills every day, even when they don't use numbers. These skills are important to anyone who is thinking critically and solving problems.

Help your students practice with the following activities:

Classifying and grouping games: Mix up many kinds of blocks and ask students to classify them by size, color, or shape. Older children, instead of using blocks, can classify and group themselves based on birthday months, color of clothing, etc.

Estimation: Using dried beans and several containers of different heights and widths, students are to guess which containers will hold the most beans and which containers will hold the fewest beans. Have students put the containers in order according to their capacity. Once the class has agreed on the order, fill each container with beans, one at a time. Count how many beans are in each container. Were they right about the order?

Patterning: Build a simple pattern using M&Ms, buttons or pieces of paper. Start with an alternating pattern (called an AB pattern): one red candy, one green candy, one red, one green, and so forth. Be sure to repeat the pattern at least once. Next, students should continue the pattern by building a sequence that's exactly like the initial pattern. "How did you know to start with a red?" or "Why did you use a green here?" Some more difficult patterns to practice are: AAB, ABB, AABB, and ABC.

BONUS:

- How do you think classifying and grouping, estimating, and patterning assist cryptanalysts like Elizebeth Friedman?
- How would you use these skills in your daily activities?

Science

What Makes Something a Science?

Science is the process of learning through observation and experimentation. Scientists ask meaningful questions that can be tested and analyzed. They use very specific tools and methods to test and study their subject. Scientists make careful observations and record their findings so that other scientists can repeat their investigations. They share their findings with other scientists and read about studies performed by others. Scientists learn through investigations, which produces evidence that helps them answer questions.

Conduct some research to find answers to the following questions:

- How can you tell if something is a science or not?
- What does it mean to be a scientist?
- Do scientific answers ever change?
- What do scientists do if their observations are not the same as before?
- What are some scientific benefits we live with every day?
- Is code breaking a science? Explain your answer using your research from the above questions.

Further information can be found at www.generationgenius.com/what-is-science-lesson-for-kids/

Types of Cryptology

Cryptology is the study of codes, or the art of writing and solving them. Below are several methods of writing code to explore.

Mirror Writing:

If you hold up to a mirror something with writing on it, the writing looks reversed. Using a sheet of thin white or light colored paper and a dark marker, write something on one side. Make sure to write it thick and dark enough so that it will show through on to the other side. Then, flip over the paper and trace the writing on the other side. It will be backwards, as if seen in a mirror. If you hold the backwards writing up to a mirror, it will look correct again.

Invisible Ink:

Write with white crayon on a white piece of paper. It will look like there's nothing there. But then use paint to cover the writing, and it will magically appear!

Cryptograph Wheel:

Create two circles of cardboard, one a bit smaller than the other, and use a protractor to mark them off into 26 pieces of about 13.8 degrees each. Write one letter of the alphabet in each division on each wheel. Then attach the two wheels together using a split pin so that you can rotate them independently. Visit <https://frugalfun4boys.com/code-activity-kids-make-spy-decoder/> for easy-to-follow instructions and a downloadable template.

Pin Marks:

Using a newspaper or a sheet of paper, make tiny pinholes under specific letters to spell out a secret message. To decipher the message, hold the paper up to a light (or window) and write down the marked letters.

Links for additional codes:

- Military Alphabet www.happychild.org.uk/ifs/00001pla.htm
- Morse Code www.happychild.org.uk/ifs/00003mrs.htm
- Various Cryptographs www.scouting.org.za/codes/sliding.html

BONUS:

Your mission (should you choose to accept it) is to encrypt the following message using at least 3 different secret codes.

THE RED BALLOON WILL LAUNCH AT NOON TOMORROW. ALERT ALL PARTIES!

DIY Invisible Ink

Students can pretend to be spies and keep all their secret messages hidden with invisible ink.

Making invisible ink is a lot of fun. All you need is some basic household objects and the hidden power of lemon juice.

You'll need:

- Half a lemon
- Water
- Spoon
- Bowl
- Q-tip
- Plain white paper
- Lamp or other light bulb

Instructions:

1. Squeeze some lemon juice into the bowl and add a few drops of water.
2. Mix the water and lemon juice with the spoon.
3. Dip the Q-tip into the mixture and write a message on the white paper.
4. Wait for the juice to dry so it becomes completely invisible.
5. When you are ready to read your secret message or show it to someone else, heat the paper by holding it close to (but not touching) a lamp or light bulb.

What's happening?

Lemon juice is an organic substance that oxidizes and turns brown when heated. Diluting the lemon juice in water makes it very hard to notice when you apply it to the paper. No one will be aware of its presence until it is heated and the secret message is revealed. Other substances which work in the same way include orange juice, honey, milk, onion juice, vinegar, and wine. Invisible ink can also be made using chemical reactions or by viewing certain liquids under ultraviolet (UV) light.

Social Studies

Codebreaking Through History

Secret writing has been employed for about as long as writing has existed. Codes have been used throughout history whenever people wanted to keep messages private. Cryptology has long been employed by governments, military, businesses, and organizations to protect their messages.

In ancient times when messages were carried by foot for miles, kings and rulers would encrypt the letters they would send to allies. This helped to protect the secrecy of the message in case they were stolen. In early American history, even George Washington sent coded messages to his fellow soldiers. Likewise, the members of the Continental Congress also encoded their documents. When the telegraph was invented, the "Morse Code" was used to send understandable messages via sound patterns.

Today, computer users encrypt documents, network space, and e-mail messages as a way to protect the confidentiality of their messages. The new types of encryption are very advanced, and sometimes complicated...but the basic skill remains true to the ancient methods!

Assign one of the following code breaker/maker people or machine students to research in the library and on the Internet.

- Navajo Code Talkers
- ENIGMA
- Bletchley Park
- Alan Turing

Possible sources for information:

- Nonfiction books
- Library research
- The Internet

Take notes and gather as much information as possible on the following three topics about your code breaker/maker or machine:

- What or who?
- Famous for?
- Other fun facts

Once the information is gathered, work to create either an illustrated poster or booklet of the findings.

Elizebeth's Legacy

A eulogy is a speech that is often given at a funeral to highlight the key events of a person's life and their legacy or what they leave behind.

Write a eulogy for Elizebeth Friedman, based on the information provided in *Code Breaker*, *Spy Hunter* and your own research.

Gender Bias in Science

We hope students today realize that girls can do and be anything boys can. But bias still exists in the science, technology, engineering, and mathematics fields.

While we rarely recognize biases within our own thinking, this activity, adapted from the Smart Tutor website, will raise consciousness and spark discussion.

1. Ask children to draw a picture of a scientist. They may not ask any questions to you or any of their peers. They must simply draw the first scientist that comes to their minds, with no talking or sharing.
2. Then, students should create a brief written description of who their scientist is and what their scientist does.
3. Ask them to share their drawings and descriptions with the class.
4. While students are sharing, chart the number of male and female scientists that students create on a graph. Do not reveal what you are doing to avoid skewing the results.

Discuss the results. Often children draw mostly male scientists in lab coats with chemicals or something of the sort. Share the graph with the students. Do the results show an internalized gender bias? Challenge the class to discuss where they feel this bias comes from and why it is harmful to society.

Use Elizebeth Friedman's experience in *Code Breaker*, *Spy Hunter* as an example.

- How have the STEM fields changed for females since Elizebeth's time?
- How have they stayed the same?
- How can we take steps to end gender bias in the sciences?