

# Secret Messages

TOPIC: FOUNDATIONAL PRINCIPLES OF CYBERSECURITY

GRADES: K-2, 3-5

LESSON DURATION: 45 MINUTES

SOFT SKILLS: COMMUNICATION, COLLABORATION

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## Learning Outcomes:

- Students will verbalize a basic definition of cryptography.
- Students will be able to explain different examples of cryptography in history and verbalize why the methods would not work in today's digital world.

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## Materials:

- Lemon juice in a cup
- Qtips/small paint brushes
- Plain white paper
- A heat source (lamp, blow dryer)
- Background material on encryption for teacher-[Chapter 5 of Blown to Bits](#) (pages 165-175)

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## Activities:

1. The teacher should explain that an important feature of cybersecurity is the encryption of data. Encryption is scrambling a message so that only people with permission/access/the key can read it. Encryption is used to protect digital information while in transit. Students should be asked for real life examples of times when information should be encrypted digitally (banking, ordering items online, secure emails, online forms with private information). Prior to the use of computers and technology, other methods were used to protect information. This lesson will focus on historical methods of cryptography or "secret writing."
2. The teacher can begin the unit with a brief overview of cryptography - the art secret writing or hiding contents of a message from all but the intended recipient.
3. The teacher can give famous examples in history (Caesar cipher, Enigma machine). This would best be included for grade levels that focus on early American history.
  - A. [Revolutionary examples](#)
  - B. [Overview](#)
4. Students will then complete an in-class activity with a partner in which they practice cryptography.
5. Directions: Kids love the idea of making invisible ink and drawing invisible pictures. Each student needs a small cup of lemon juice, paper, and a Qtip. Students should use the Qtip and juice to draw whatever they would like on their paper-it can be a message or a picture. They should not tell anyone what they are drawing/writing. They should not use too much lemon

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juice or it will be hard to read. Let the drawing on the paper dry. While the paper is drawing, each student should be assigned a partner.

6. After the paper is dry, each student should exchange papers with their partner. The partner should attempt to decipher the message. In this case the key is actually heat. To see the picture, simply hold the paper near a heat source such as a light bulb or a blow dryer (if available). As the paper warms up, the lemon juice picture will darken so you can see it.
7. After the activity, the teacher could ask students for positives and negatives of this methodology. Using the information that they stated before (banking, personal information, etc), ask them if they would feel comfortable writing it in lemon juice. Although students may be young, they will still grasp the insecurity of this method.
8. For more advanced learners, the teacher may choose to introduce the Caesar cipher and allow students to complete an activity with a cipher.

*Teacher note: How does it work? Lemon juice is acidic and the acid weakens the paper making it more sensitive to heat than the rest of the paper. As the paper is heated, the acidic parts of the paper burn or turn brown before the rest of the paper does.* Adapted from: [http://www.universalpreschool.com/how-to/learning\\_with\\_lemons.asp](http://www.universalpreschool.com/how-to/learning_with_lemons.asp)

More information can also be found at the CERIAS website (Purdue University): [https://www.cerias.purdue.edu/education/k-12/teaching\\_resources/lessons\\_presentations/cryptology.html](https://www.cerias.purdue.edu/education/k-12/teaching_resources/lessons_presentations/cryptology.html)

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