Early Cryptography: The Caesar and Substitution Ciphers

TOPIC: FOUNDATIONAL PRINCIPLES

GRADES: 3-5, 6-8

LESSON DURATION: N/A

SOFT SKILLS: COLLABORATION; CRITICAL THINKING

Introduction:

- This activity is a beginner activity to introduce students to a basic type of cryptography. This lesson can be used in math, English, or social studies. Teachers may insert into curriculum involving patterns, computational thinking, espionage, Caesar's influence, etc.

Learning Outcomes:

- Students will understand the benefits and weaknesses of the Caesar cipher as a means of sending encrypted messages.
- Students will complete a hands-on activity using a Caesar cipher.

Materials:

1. Background information regarding the cryptography
2. Paper cut-out of the cipher wheel
3. Pin/attachment to connect the 2 wheels (smaller on inside)
4. Activity sheet for students
5. Teacher activity sheet (with answers)
6. Basic explanation of cipher with math formulas

Activities:

1. Introductory activities are dependent upon the unit in which the classroom teacher is using this activity. For example, in social studies the teacher may spend more time on the history of the empire and espionage. However, in math class the teacher can focus more on the methodology of encryption and then history of ciphers.
2. Once the background information has been given, the teacher should hand out the paper ciphers. Students should cut them out and assemble the cipher.
3. Students should then be handed the activity sheet. Working in pairs, the students should complete the hands-on activities included on the sheet.
4. When all students have completed the activities, the teacher should end the activity by explaining that this form of cryptography is not functional in today's world. Ask the students to list the weaknesses of this system (such as the fact that there are limited options-no way would we want e-commerce transactions depending on this methodology). Explain that one of the many benefits of computing systems is that encryption is now far more advanced. If you

had a very long message that you wanted to encrypt, it could take months. A properly programmed computer could do the work for a large amount of text in less than a second and could be more secure. The computer must be programmed with the algorithm to complete the task.

5. If the teacher should choose to complete this activity online, a website is available. It's more engaging for students to work with a partner and use the paper version. Online source: https://learncryptography.com/tools/caesar-cipher

6. Another online resource is available on the CSUnplugged website. The link is available here: http://csunplugged.mines.edu/Activities/Cryptography/CryptographyWorksheets.pdf.

7. Finally the teacher may choose to use other examples of substitution ciphers. There are a multitude of online resources that can be used in the classroom.

Enrichment/Follow-up:

1. The teacher may consider other cryptography/cipher activities. Hands-on or online activities are available through a simple google search.

2. This source from Dartmouth could serve as a tool for taking students through more examples of cryptography: https://www.math.dartmouth.edu/~ddeford/Crossroads_pdfs/Activity_Worksheets_2.pdf