March G&T Unit: Cryptography

Content Area: **Gifted and Talented**
Course(s):
Time Period: **March**
Length: **6-8 Weeks**
Status: **Published**

Unit Overview

Students will utilize critical thinking skills in the study of "Cryptography." Students will study codes and ciphers and create their own BreakoutEDU box challenge.

Enduring Understandings

- Cryptography is the science of secrecy.
- Computing enhances communication, interaction, and cognition.
- Cryptology is the practice of making codes to protect information.
- Cryptology has been in use almost as long as written language.
- Modern cryptology uses complex mathematics to develop codes.
- Cryptography, or the art and science of encrypting sensitive information.

Essential Questions

- How does cryptography work?
- How has cryptography been used throughout history?
- How has cryptography changed over time?
- How do I choose, use, and troubleshoot technology to empower my learning?
- How do we use math based codes in our everyday lives?

Instructional Strategies & Learning Activities

1. Have a discussion about the symbols units (ancient Egypt and the MoliStone Project M3 math unit) the students completed in 3rd grade. Discuss hieroglyphics and the math numeration systems they studied.
2. *2.* Read *Top Secret: A Handbook of Codes, Ciphers, and Secret Writing* **By Paul B. Janeczko** (in library). Highlight words and ideas that are new. Discuss difference between code and cipher. Discuss examples as a class and record definitions on their vocabulary worksheet to keep in their binder.
3. *3.* Watch youtube video documentary from "National Treasure" movie about codes and ciphers https://www.youtube.com/watch?v=-413tlhPDZo
4. Cryptology game- Divide the group into two teams, each team split into two smaller groups (these should be 3-5 kids, if there are too many, make additional teams). Try to keep messages around 8-10 words long. Give the kids movie quotes if they cannot think of messages to send. Round 1: Each group

will get a message to encode to their team mates as they choose. The first team to code and decode both messages wins this round. Round 2: Each team will be given two coded messages, one that their "General" is sending them, for which they know the decryption key, and one that is meant for the other team, but was intercepted, for which they do not know the decryption key. The fist team to decode both their own message and the intercepted message wins. If time remains: Play a round three in which the teams have 1 minute to discuss a key with their entire team, then the teams split back to opposite sides of the room, encode their own messages, and communicate the key and the message to their team mates best, without the opposing team decrypting it first. Both teams will be given the codetext, but only team mates will have the keys. See if the codes can be broken. https://www.uccs.edu/Documents/pipes/cryptology-cdio.pdf

5. Read Codes and Ciphers pages from Prufrock Press and answer questions after.
6. Letter frequencies- pass out handout and discuss. The table shows the percent frequency of each letter in the English alphabet. Discuss how this information can help decode secret messages when only some of the cipher text is known.
7. Substitution ciphers -you line up the plain text alphabet with cipher text alphabet underneath. Students practice with a partner, encrypting and decrypting messages.
8. Plaintext letter A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
9. Ciphertext letter Q W E R T Y U I O P A S D F G H J K L Z X C V B N M
10. Pigpen ciphers- Explain the history behind the Pigpen cipher and the Freemasons -do two pigpen cipher sheets to practice. Students then create their own for a friend to solve.
11. Caesar cipher- http://www.counton.org/explorer/codebreaking/caesar-cipher.php explained on this website- practice decoding on the website.
12. School code challenge- try to crack a few different codes https://schoolcodebreaking.com/code-challenge-level-1/
13. Two-Square Cipher- Students learn about this substitution cipher and then decode secret messages.
14. Make a scytale- https://www.uccs.edu/Documents/pipes/cryptology-cdio.pdf
15. Read Readworks article about Louis Braille- students complete questions at the end. Can be used for homework.
16. Read Newsela article "World War II code cracker Mavis Batey." Students complete questions at the end. Can be used for homework.
17. Read Newsela article "Navajo Code Talkers" and answer questions after. Can be used for homework too.
18. Students will research careers that use cryptography. Students will work in groups to create a short presentation for the class about how cryptography has changed over time with the advent of modern technology.
19. Students will solve two BreakoutEDU box challenges in small groups. https://www.breakoutedu.com/thespyderheist and one teacher- created. Any BreakoutEDU games can be used on their website.
20. Students will work in groups to create their own BreakoutEDU box challenge for their classmates to solve. Students will use the BreakoutEDU game template format https://docs.google.com/document/d/1aAmC1sQ810GKA0XfOu7uIveNgdTGBpiAa2w8a1dSFT0/edit
21. If approved by the BOE, students will take a field trip to an escape room to put their skills to the test.

Integration of Career Readiness, Life Literacies and Key Skills

Career links: Data Security Analyst • FBI Agent • Police Officer • Business • Credit Bureau • Global Payment and Technology • Cryptologist/cryptographer

9.4.5.CI	Creativity and Innovation
9.2.5.CAP	Career Awareness and Planning
	An individual's passions, aptitude and skills can affect his/her employment and earning potential.
	Collaboration with individuals with diverse perspectives can result in new ways of thinking and/or innovative solutions.
9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.4.5.CI.1	Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
9.2.5.CAP.2	Identify how you might like to earn an income.
9.4.5.CI.2	Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.4.5.CI.3	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CI.4	Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.5.DC	Digital Citizenship
9.4.5.DC.1	Explain the need for and use of copyrights.
9.4.5.DC.4	Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).

Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).
Formative Assessments used in this unit:

Teacher observation

Discussion

Assignments

Technology and Design Integration

Students will use various websites to explore codes and ciphers. Students will use the computer to solve their BreakoutEDU challenges.

CS	Computing Systems
	Computing devices may be connected to other devices to form a system as a way to extend their capabilities.
8.1.5.CS.1	Model how computing devices connect to other components to form a system.
	Software and hardware work together as a system to accomplish tasks (e.g., sending, receiving, processing, and storing units of information).
	Shared features allow for common troubleshooting strategies that can be effective for many systems.
8.1.5.CS.3	Identify potential solutions for simple hardware and software problems using common troubleshooting strategies.

Interdisciplinary Connections

Math, science, reading, writing, history, technology

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

Assignments

Projects

Differentiation

- Understand that gifted students, just like all students, come to school to learn and be challenged.
- Pre-assess your students. Find out their areas of strength as well as those areas you may need to address before students move on.
- Consider grouping gifted students together for at least part of the school day.
- Plan for differentiation. Consider pre-assessments, extension activities, and compacting the curriculum.
- Use phrases like "You've shown you don't need more practice" or "You need more practice" instead of words like "qualify" or "eligible" when referring to extension work.
- Encourage high-ability students to take on challenges. Because they're often used to getting good grades, gifted students may be risk averse.
- **Definitions of Differentiation Components**:
    - Content – the specific information that is to be taught in the lesson/unit/course of instruction.
    - Process – how the student will acquire the content information.
    - Product – how the student will demonstrate understanding of the content.
    - Learning Environment – the environment where learning is taking place including physical location and/or student grouping

Differentiation occurring in this unit:

Gifted and talented curriculum is structured to offer students additional challenges based on individual needs and interests.

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.
Modifications and Accommodations used in this unit:

IEP and 504 modifications if necessary

Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.
Schoolwide Benchmark assessments:
Aimsweb benchmarks 3X a year
Linkit Benchmarks 3X a year
Additional Benchmarks used in this unit:

Teacher observation and notes to document growth over time and grade levels.

Instructional Materials

See materials listed in “Instructional Strategies,” as well as the following websites:

https://thebestvpn.com/cryptography/#history

https://www.breakoutedu.com/

https://www.tuxpi.com/photo-effects/wanted-poster

https://m.photofunia.com/

http://wigflip.com/easystreet/

https://www.fodey.com/generators/newspaper/snippet.asp

https://www.pinterest.com/kathleenahall/breakout-edu-resources/

http://www.fakereceipt.us/sales_receipt.php

https://bighugelabs.com/badge.php

http://www.fttechtips.com/blog/breakout-edu-a-game-changer-in-engagement

http://www.thingiverse.com/thing:1533742

https://www.youtube.com/watch?v=kn0PVtbGDvI

https://sites.google.com/a/edu.etsb.qc.ca/beduheist/?pageDeleted=true

http://www.picturedots.com/

https://www.worksheetworks.com/math/geometry/graphing/secret-line-message.html

http://www.breakoutedu.com/time-warp

http://goqr.me/#t=url

https://en.wikipedia.org/wiki/Beale_ciphers

https://www.youtube.com/watch?v=sKMxtfMSPTM

https://www.youtube.com/watch?v=glSLwvR0EXo

https://docs.google.com/document/d/1cbKbAhn2d1PxKcM-DUyZawXjkeeHQTYgcxJLXeVHp7U/mobilebasic

https://www.pinterest.com/pin/63683782209580508/

https://s-media-cache-ak0.pinimg.com/originals/d2/0e/7e/d20e7e421f1942dfa3d766059fd0a9f6.jpg

http://www.hplhs.org/resources.php

https://sites.google.com/site/yehbreakouts/hhe

https://sites.google.com/site/digitalbreakouttemplate/home

http://snotes.com/

https://boonjin.com/mystery-piano/

https://spark.adobe.com/video/WpvRlecuRa3Mi

http://1.bp.blogspot.com/_LXK7ANwMDIc/TQ-Tzzky8DI/AAAAAAAAEqo/1W1hyNkkOlc/s1600/CraftySecrets-ChristmasSongsRiddleGameWEB.jpg

https://www.youtube.com/watch?v=XqULAuVx2Os&t=7s

http://bellbulldogreaders.edublogs.org/2016/09/07/breakout-to-checkout/

http://facilitationtool.breakoutedu.com/index.php?key=6kqr7lKfsuyR94e

https://platform.breakoutedu.com/

https://docs.google.com/spreadsheets/d/1YIlIE6AL_L4QGr6WC0Oy7i7rQRGpfsSMrFbpEvE6zts/edit#gid=1799666614

https://sites.google.com/hcs-students.net/polarexpress3-5/home

https://sites.google.com/hcs-students.net/polarexpressk2/home

https://docs.google.com/forms/d/e/1FAIpQLSd5Wpa9r44ydRGQfpAv6boTY8JJ5t7BuRo43gsedFYHgZE45g/viewform

http://www.meridianoutpost.com/resources/etools/calculators/calculator-morse-code.php

http://hldennis.com/team-veritas/other-secrets-to-break/

https://codemoji.org/#/encrypt

http://littlebinsforlittlehands.com/christmas-coding-activity-stem-ornament-binary-alphabet/

http://www.exploratorium.edu/ronh/secret/secret.html

http://crypto.interactive-maths.com/

https://schoolcodebreaking.com/

https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/intro-to-cryptography

http://rumkin.com/tools/cipher/

https://www.youtube.com/watch?v=-yFZGF8FHSg

https://www.youtube.com/watch?v=-413tlhPDZo

http://bowmanclassroom.tripod.com/

http://www.counton.org/explorer/codebreaking/index.php

http://www.indigoimage.com/secretmsg/

http://www.educationworld.com/a_lesson/03/lp296-02.shtml

http://www.loc.gov/exhibits/lewisandclark/images/lcp0031s.jpg

http://www.glassgiant.com/geek/morse/

http://ciphermysteries.com/wp-content/uploads/sites/6/2016/03/john-farmer-dakin-pigpen.jpg

https://en.wikipedia.org/wiki/Thomas_Brierley#/media/File:Thomas_Brierley_memorial.jpg

http://shootingparrots.co.uk/2011/08/30/history-mystery/

https://thebestvpn.com/cryptography/#history

Standards

In addition to cross curricular standards listed above, National Association for Gifted Children Standards endorsed by NJDOE are applied.