

1.0 ngMaki It Dciuffti to daeR

Suppose you had the letters B, E, E, H, I, K, L, S, S, T, U, and Y – could you figure out the original phrase that these letters came from? People who play Scrabble or Words with Friends could use their vocabulary knowledge to make different words from available letters, but what we want is to recreate the original phrase that these letters made.

What if instead of giving just the list of letters in alphabetical order you were given the same set of letters but written in this form: HET KYS SI LUEB – does that help in figuring out the original phrase? Time to take a closer look!

1.0.0 Explore: ngMaki It Dciuffti to daeR

Focus Question: How can we use patterns to rearrange the elements of a message?

- 1) On the front board of the classroom for anyone to see, Sandy wrote the following message to her best friend Terry who will have class in the same room next period right before lunch:

LSTE OREDR A PAZZI FRO LHCNU

Sandy and Terry came up with their private writing system a few weeks ago and feel confident that people who don't know the method will not be able to figure out what their messages say.

- a) Are you able to figure out what their message says? Explain how you went about trying to figure out what their message says.

- b) The next morning Terry wrote a message to Sandy about this weekend's party for Jill.

NDEE YUO TO SNGI TEH BYAD CDRA

What does the message say?

- c) Describe (not verbally but on paper) how the method used by Sandy and Terry works.

- 2) Terry and Sandy realized that they had to change their message system the day they walked into a class together and saw the following written on the front board:

WE FDERUGI OTU YRUO MDOHTE

Terry and Sandy will need to develop a new encryption method. Can you help them?

- a) Working with a partner, make a list of criteria that will help make your cipher more difficult for others to crack.
- b) Using the features you and your partner discussed in (a), create an encryption method. Write the details of your method below – but keep it secret from others!
- c) Apply it! Write a school appropriate message of roughly 20 – 25 characters then encrypt the message using your encryption method from (b).

- 3) It's time to "eavesdrop" on the ciphertext of another pair! Following your teacher's instructions, examine the ciphertext of another partnership.
- a) Can you determine what their message says? Do you notice any patterns that would help you uncover their encryption method?
 - b) What made the message(s) easy and/or difficult to decipher?

- 6) Now that someone has figured out their writing pattern, Sandy is asking for help to figure out a new pattern for securing their messages. She wants to send the following message to Terry:

MEET AT THE LIBRARY TONIGHT AT 8PM.

- a) Working with a partner, make a list of criteria that will help make your cipher more difficult for others to crack.
- b) Using the features you and your partner discussed in (a), create an encryption method and describe the steps to encrypt the message. Write a description of the method for Terry to figure out how to read (decrypt) the message. Write the details of your method below – but keep it secret from others!
- c) Apply it! Using your encryption method, create the ciphertext for Sandy’s message.

- 7) Gather from at least four other groups the secret messages they created for Sandy in the previous task.
 - a) Rank the different methods from the easiest to the most difficult to “figure out” and write a brief explanation for how you decided your ranking of the methods. Your explanation should reference specific features of each method.
 - b) Which methods are similar and what makes them similar? Does any method seem to be unlike the others? What makes this method seem different?
 - c) Compare/discuss your answers to the questions. Then come to a consensus as a group of how the methods should be ranked from easiest to most difficult to “figure out” and post your ranking on the board.

1.0.1 Reflect

- 1) What do you think makes a good cipher?
- 2) What makes one cipher more secure than another?

ngMaki It Dciufllti to daeR - Problem Set

Check for Understanding

- 1) What does “cryptography” mean to you at this point? What is the purpose of cryptography?
- 2) What are some features of a secure system?

Repeated Reasoning

- 3) Develop another variation of the cipher that Sandy and Terry used (Lesson 1.0.0). Describe your cipher system – be specific! What are the benefits and drawbacks of your method?
- 4) Now that someone has figured out their writing pattern, Sandy spent some time over the weekend brainstorming new patterns for writing a message. Below are examples of the same message written using five different methods:

- i. HT8P MMEE TATT HELI BRAR YTON IG
- ii. MLNE II EBG TRHAATT R8TYPHT MEO
- iii. THGI MMP8 ATEE EHTT RBIL TYRA NO
- iv. TEEM TA EHT YRARBIL THGINOT MP8
- v. HIM RTN HTB MYA IE8 RET TGL PAE OT

- a) Rank the different methods from the easiest to the most difficult to “figure out” and write a brief explanation for how you decided your ranking of the methods. Your explanation should reference specific features of each method.
- b) Which methods are similar and what makes them similar? Which method seem to be unlike the others? What makes this method seem different?

Diving Deeper

- 5) Work with a friend and develop your own unique cipher system. Your cipher system should allow you and your friend to easily share messages, but if anyone else sees the ciphertext they will be unable to determine its meaning. Encrypt a message of your choice then answer the following questions:
 - a. What is needed to encrypt a message? That is, how does your encryption process work? Is your method generalizable to messages of any length? Why or why not?
 - b. If someone saw the ciphertext you created, but didn’t know the encryption method, do you think they would be able to decrypt the message? Why or why not?
 - c. How does decryption work? That is, once your partner receives the message, how do they read the contents? Be specific.

- 6) Cryptography plays an important role in communication and has an abundance of modern and historical examples. Are there any examples of communicating secret information that you are familiar with? What was the importance of keeping information secret? How was secrecy achieved?