Creating a Coding Language

Summary:
Students will learn about Caesar Ciphers through the use of their own, and applying different translation models to try and solve a riddle. They will practice critical thinking skills, problem solving, and social skills throughout the activity, and it allows for independent work time, as well as group work. This lesson is a basic introduction to cryptography, language, and also has a sister component that students can try.

| Audience: K-8 | Plugged or unplugged: Unplugged |

Author: Maximo Avendano, California School for the Blind
California State Standards for Language Arts:

- 1.2 Write upper- and lowercase letters of the alphabet independently:
  Students will write upper- and lowercase letters of the alphabet on braille paper as part of designing their coding language.
- Students will write and decode secret messages using their coding language.
- 2.1 Identify and know the meaning of the most common prefixes and derivational suffixes:
  Depending on the complexity of the coding language, students may use prefixes or suffixes to create their coding language.
- 3.2 Write clear and coherent sentences and paragraphs that develop a central idea:
  Students will write and decode secret messages using their coding language, which will require clear and coherent sentences.
- 4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information:
  Students can write an opinion piece on the importance of keeping messages secret, or on the effectiveness of their coding language.
- 5.2 Write summaries that contain the main ideas of the reading selection and the most significant details:
  Students can write summaries of the secret messages they create and decode using their coding language.
- 6.3 Write narratives to develop real or imagined experiences or events:
  Students can write a narrative using their coding language, in which they communicate a secret message to another character.
- 7.2 Write responses to literature:
  Students can write a response to a story that involves secret messages, in which they discuss the role that the coding language played in the story.
- 8.2 Write expository compositions, including analytical essays and research reports:
  Students can write an analytical essay on the history of cryptography and how it has been used throughout history.

California State Standards for Math:

- 3.OA.8 Solve two-step word problems using the four operations:
  Students can solve word problems involving their coding language, such as: "If the message is encoded with a Caesar Cipher that moves each letter two places to the left, and the decoded message is 'hello', what was the original message?"
- 6.EE.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another:
  Students can use variables to represent the amount that each letter in their coding language is shifted when encoded and decoded.
Materials needed:
- Brailler
- Braille paper
- Bold line pens
- Tape/glue
- Scissors

Prerequisite skills:
- Students need to be able to read letters, whether in large print or braille.
- Students also need to know how to load braille paper, and use a Perkins brailler.

Time Estimate: 45 mins.

Objectives:
1. Students will create a simple coding language in braille (with accompanied print) and use it to write and decode secret messages to share with a friend.

Instructional Sequence:

1. Introduction
   Begin the lesson by asking the students if they've ever wanted to write secret messages that only their friends can understand, and if they have ever wondered about how they might go about it. Explain to them that they will be creating their own coding language in braille that will help them write and decode secret messages.

2. Design the Coding Language in Braille
   Have students work in pairs or small groups to design their own coding language in braille.
   1. For this, you will need students to write out the alphabet on braille paper, making sure that they can write it out in one line. We recommend inserting the paper in "Landscape", making sure that the paper is inserted long-ways.
   2. Next, have students make two new lines and write out the alphabet again, because the goal will be to stack the two alphabets on each other, and having the extra space makes it easy to put on and stay on.
      a. For large print users, the goal is the same—substitute braille for large print, and braille paper for any adequate paper with good spacing for the student(s).
   3. Once the students have completed the two sets of alphabets, the paper can come out of the brailler and be cut into the two strips, with the bottom one being cut just above the letters.
   4. Wrap the two strips of paper around themselves so that the a and z are close together and tape them so that
<table>
<thead>
<tr>
<th><strong>they stay in shape.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Stack the first strip on top of the smaller strip and make sure there is room to rotate.</td>
</tr>
<tr>
<td>6. Demonstrate the cipher: By having them lined up so that all letters match, and then moving them one letter left or right, create the cipher.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>New language with a friend</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Now students try! After having done the demo, and making sure students understand how they can encrypt a message, have them decrypt a word by moving their Caesar Ciphers two letters in either direction.</td>
</tr>
<tr>
<td>a. &quot;Hi&quot; or &quot;Hello&quot; are great starting points. So the student will write out &quot;Hi&quot; or &quot;Hello&quot; and then twist the bottom alphabet a few letters, and then write out the letters that now represent the &quot;H&quot; and &quot;I&quot;. For example, Hi becomes Jk if the Ciphers are shifted two letters to the left.</td>
</tr>
<tr>
<td>2. Next, students pass along the decrypted message to another student along with the Caesar Cipher key, and the student then has to decipher the code! They have to translate either two left or two right.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Expanding</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There are many ways to expand on this lesson in different academic areas. Examples: You can also create a cipher with numbers, and attribute each letter to a number, and translate them the same way.</td>
</tr>
<tr>
<td>In science, you can create a Key with the periodic table, and have students solve a riddle if they are more advanced learners.</td>
</tr>
</tbody>
</table>

Author: Maximo Avendano, California School for the Blind