Unplugged Chain Teacher Instructions

Mission 2: Neuron Navigator, Objective 2

The activity for this objective is to run a simulation of an artificial neural network. In this class activity, each student will act as a neuron, carrying a signal message from initial activation to response.

Materials Needed:

- Role cards printed and prepared (enough for each student to have a role, see Materials)
- Colored paper to act as the initial signal for the eye neurons
- 2 decks of cards, at least ½ pack per eye neuron
- Activity Guide printed for each student (record observations after each scenario)
- PowerPoint slides to introduce the neural network
- A way to organize the rows of neurons for each simulation (see Materials for scenarios)
  Some suggestions are:
  - Project the scenario on a screen
  - Place pieces of paper on the floor for students to stand on

1. Step #1: Assign roles.
Each student gets a neuron card. Select the number of neuron cards you need (one per student), and which ones you want to use for each simulation. Some suggested neural network configurations are provided. Each simulation should have:

- 2-4 eye neurons (Eye neurons start sending messages when they see a specific color)
- 1 final (or snap) neuron (It performs the action when it receives signals at full strength)
- All other students are brain neurons.
  - For the first simulation have all excitatory neurons (pass signals instantly)
- After the first simulation, add in inhibitory and malfunctioning neurons. Use a different mixture of brain neurons for each simulation so the observations can be different.
  - Inhibitory neurons delay passing the signal for a certain amount of time.
  - Malfunctioning neurons either skip a turn or fail to pass the signal.

2. **Step #2**: Line up in a neural network grid.

- Eye neurons are up front.
- Each eye neuron gets a stack of playing cards
- Brain neurons spread out in rows. Each neuron should have at least one neuron in front and behind for receiving and sending signals.
- The final neuron stands at the back.
- See example grids for help in lining up students for the simulation. You can use pieces of paper taped to the floor to help students know where to stand.

3. **Step #3**: Start the simulation.

- The eye neurons wait until they see the specified color.
  - Select a color in advance (pieces of colored paper work well).
  - You, or a designated student, start the simulation by showing the colored paper to the eye neurons.
  - The eye neurons are the only neurons that detect the color and start firing signals.
- The eye neurons fire a signal to all neurons they are connected to.
  - To fire a signal, hand a card from a deck to a neuron.
  - An eye neuron fires a signal (hands a card) to each neuron it is connected to.
  - The eye neuron will have to fire multiple signals to the connected neurons. Each neuron has to reach a required strength before it can in turn fire a signal.

- The brain neurons wait to receive a signal from a connected neuron. Each neuron has to reach a signal strength before they can fire a signal to the next connected neurons.
    - The required signal strength is printed on the role card.
    - Once the signal strength is reached, they will fire a signal by passing a card to their connected neurons. In the meantime, they can continue to receive signals.
    - Excitatory neurons send the signal instantly (once strength is reached) to the next neurons.
    - Inhibitory neurons wait to send the signal to the next neurons. The amount of time to wait is printed on their role card.
    - Malfunctioning neurons either skip a turn and wait for more signals, or throw out the signals all together. Their action is printed on the role card.
- When the final neuron reaches full signal strength, the student performs the action printed on the card.

4. **Step #4**: Students record their observations.
    - Give students time to record their observations on their instructions document.
    - Collect their role cards and the decks of cards that were used during the simulation.
    - While students record their observations, you can reset for the next simulation.
    - Get the role cards ready and decks of cards for each eye neuron.

5. **Step #5**: Repeat the simulation several times.
    - Steps 1-4 for each scenario.
    - Use different numbers of eye neurons, excitatory neurons, inhibitory neurons and malfunctioning neurons. Use just one final neuron for each simulation.

6. **Step #6**: Final reflection.

Have students log in to CodeSpace to write a reflection of the artificial neural network activity.

- Create file ***unplugged_chain***
- Write at least one paragraph that answers the prompts.
- Prompts:
    - Think about how each "neuron" plays a unique role in ensuring efficient brain communication.
    - Write at least one paragraph explaining your role in the Unplugged Chain activity and what you learned from this exercise.
    - Make sure to include important vocabulary learned in this Mission.