SATURDAY ENRICHMENT SPRING 2022

Neuroscience Experimental Design

Instructor: A.J. Balatico
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Location: Mary Gates Hall (MGH), Room 254

Course Description
How many numbers can you remember backwards? How much sugar is too much? Does practice actually make perfect? As a class, we will perform a variety of experiments to test reflexes, memory, senses, and movement while diligently recording our results. Each week we will analyze and compare our results to look at trends in our data. Did we get better or worse? Lastly, we will research various parts of the brain and design experiments to test variables within and across people and environments. Students will share their results on a scientific academic poster.

Essential Questions
- How do we even know what’s going on in the brain?
- How is performance affected over time?
- How do we measure behaviors or outcomes in an experiment?
- What is “scientific” and what is replicable?
- In what ways can we use data to tell a story?

Learning Outcomes
Students will:
1) develop critical thinking skills around connected science topics of their choice.
2) design experiments to investigate natural phenomena.
3) give and receive constructive feedback on their presentations and thinking.

Instructional Strategies
The instructor will introduce neuroscience topics by framing topics related to everyday experiences (We all have brains!). Students will investigate their chosen topics and design experiments to deepen their understanding of their topic. Students will receive guidance to bound their projects to something they can complete over eight class periods. The instructor will provide mentored feedback for projects, as well as relevant articles and media related to a topic. “More research is needed” is a common phrase across academic fields, but it is too true. Although it is not possible to learn absolutely everything about a topic, students will use scientific ways of thinking to develop mathematical or logical models about their topic. Students can expect to develop their interests and to make meaningful connections to other things they have learned.

Time in class is relatively short, but students should be able to complete their projects in class. Students with ambitious goals for their work may wish to work outside of class, but this is not a
requirement of the course. If a student misses a class, however, they may need to adjust their project or timetable to reach a satisfactory conclusion.

**Resources and Materials**

Each class will have handouts related to the topic with links and resources for students to use in and out of class. We will occasionally go online on laptops to independently look up topics of interest in neuroscience, such as experimental protocols, tasks, images, tongue twisters, and optical and auditory illusions.

**Tentative Courses Schedule**

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<th>Date</th>
<th>Topics and In-class Activities</th>
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| Week 1 – April 2 | Data Tracking and Graphing  
We will go over how we can record data to analyze and how we can share information with others. |
| Week 2 – April 9 | Measuring Performance  
We will design activities to see how many repetitions we can do. Then we’ll do it again. And again. And again. And then we’ll see some trends. |
| Week 3 – April 16 | Revisiting Last Week  
We will review last week to see if we can get better performances. How can we learn more by doing what we did last week, but slightly differently? How much change is too much change? Did we learn any tricks? Did we get worse? |
| Week 4 – April 23 | Drawing Challenges  
Artificial intelligence has gotten very good at identifying drawings. Can we beat a computer? |
| Week 5 – April 30 | Researching Phenomena  
What do “we” know about our topic of interest? How do we know that information is coming from a reliable source? Can we repeat it? |
| Week 6 – May 7  | Experiments and Data Collection  
We will design a protocol to test others in the class, including A.J. and our T.A. What variables are being tested? What factors can help explain our results? Does what happened make sense? |
| Week 7 – May 14 | Critique and Replicability  
Is what you designed in Week 6 something that other people can do? Does the same protocol lead to different results if you test it on different people? It probably depends. |
| Week 8 – May 21 | Scientific Academic Poster Session  
We will celebrate and share our work with each other. |