**ACTIVITY TITLE: Prism Shift Goggles**

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| \***Theme**: | Neural plasticity and motor and visual system |
| \***Objective**(s):*(What key learning do you want students to come away with?)*  | * Show how sensory input and behavioral output can be modified over the course of a few trials
* Learn that plasticity is the brain’s ability to adapt to environmental changes or new experiences
* Learn that the cerebellum is important for short-term adaptation
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 **LESSON OUTLINE:**

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| **1. Introduction:***Plan a script of what you will say to start.**- What will this be about? Why’s it interesting?* *(Hook)* | Q: does anyone know what plasticity is? A: Plasticity is the ability that our brains have to adapt to new environments that is necessary for learning. An example of this is when you try to are bowling with a heavy ball, and then accidently pick up a lighter one. You have to adapt how you throw the bowling ball because of the environmental change (a lighter ball). Today we are going to participate in an activity where you can experience brain plasticity! |

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| **2. Building Background:***List questions you can use to immediately engage your audience and prepare their thinking for your activity.**-What prior knowledge might they have about/related to your topic?* *-What prior knowledge (background) do they need for your activity?* | Participants should be 8+ years to play this game.* Plasticity is necessary for you to be able to adapt to the world around you!
* Plasticity occurs at every synapse in your brain!
* **Q: Why is plasticity important?**
* **A: It allows us to learn and adapt to a changing environment!** If our brains were not plastic, we would not be able to learn anything new. It occurs by strengthening and weakening connections in our brain as we practice or learn something new.
* Relating to the activity we are about to do: As we learn to play a sport, we use a lot of visual information to calibrate where to throw or kick a ball. The parts of the brain involved in this task are the visual and motor systems.
* Visual system is needed to detect and use visible light to build a representation of our environment.
* Motor system is in charge of movement, and includes many different areas (motor cortex, basal ganglia, cerebellum, spinal cord)
* **The cerebellum, or “little brain”,** is important to update the maps of the world around us (specifically the movement space), as our visual environment shifts/changes.
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| **3. Lesson & Activity:***Outline the key components of your lesson.***Plan/Note**:- key ideas/ vocabulary- scaffolds - images/media- extension questions\*Consider how to best deliver your content! \*Plan interactive components that encourage active thinking in your students. | * We will play a game where we will wear goggles and toss bean bags at a target!
* Ask for a student volunteer.
1. Toss the bean bag to the target
2. Continue tossing the bean bag until they are reliable hitting the target. Count each attempt to keep track how long it takes for them to have high accuracy.
3. Now, ask the student to put the prism goggles on.
	1. Q: what are the goggles doing? (Ask the student to describe it)
	2. Answer: the goggles bends light coming into their eyes, so everything the wearer sees appears to be slightly shifted, even though they haven’t moved their body. So your brain is “seeing”/perceiving is different than what is actually there
4. Adaptation phase: Throw the bean bag with the glasses on
	1. They will miss, badly. Their vision is shifted so it makes sense they’d miss.
5. Keep throwing until they get improve their accuracy-- keep track of how long it takes.
6. Post-adaptation: take off the goggles and QUICKLY throw the bean bag again. They’ll probably miss! Because they have adapted to the vision shift, they will have trouble.

NOTES: don’t let the kids walk around with the goggles, since they might fall/bump into things.  |

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| **4. Wrap Up:***- Review key ideas**- Share takeaways and final thoughts**- Discuss connections to other questions and ideas. Extensions.**- Ask: Who could you teach what you learned here today?**- Ask/Suggest: What can I do to learn more?* | If you have time, extend the discussion with the following questions.Q: Why was it hard to hit the target once they put the goggles on?Q: Do you know what the goggles were going?Q: How did your brain adapt?Q: Why would our brains be able to have adapt in this way?Final thoughts: You now see that the visual and motor system work together to make coordinated movements, and with the cerebellum we can correct movements quickly with changing environments! |

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| **MATERIALS NEEDED: *\*\*(please list all items and quantities necessary for preparation)*** |
| 1. Prism shift goggles
2. Bean bags
3. 2-3 targets
4. Score sheets
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\*\*attach any printouts to end of document here

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| **Other Notes**  |
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**Extra Resources:**

<http://students.washington.edu/nbout/LessonPlans/prismgoggles.pdf>

https://www.exploratorium.edu/snacks/distortion-goggles