GENERATIONGENIUS
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DIY ACTIVITY

THE RULER DROP EXPERIMENT

GRADES 3–5

OBJECTIVES

- Learn about reaction times.
- Test their own reaction times in repeated trials.
- Experience how nervous system processes send signals to the brain from the sense of sight.

MATERIALS NEEDED

- Science notebook and a pencil
- A ruler

Activity Duration: 30–40 minutes

PROCEDURE

WATCH THE GENERATION GENIUS BRAIN PROCESSING VIDEO

1. Divide the class into pairs. Give each pair a ruler. Have each student draw a 7 column, 2 row table in their science notebooks that looks like this: *(add 2 more rows if performing optional tests)*

Name	Trial 1 cm	Reaction time sec.	Trial 2 cm	Reaction time sec.	Trial 3 cm	Reaction time sec.
Visual Test						
Optional tests						
Auditory Test						
Touch Test						

2. Ask each team to discuss together what they think their results might be, and write their predictions in their notebooks.
3. Explain that in each team, one student (the dropper) will drop the ruler and the other student (the catcher) will attempt to grab the ruler between their fingers and thumb. The one who grabs the ruler (the catcher) will record in their own science notebooks the number (in cm) above where their fingers land on the ruler. Each person will perform 3 trials and then they will switch roles.
4. Ruler Drop Method:
   Visual Test: The catcher will sit at a desk or table with their arm resting on the surface and their dominant hand (right or left) off the edge of the table. The dropper will go in front of the catcher and hold the ruler straight up and down, with

their thumb and one finger at the 30-cm end (the 12-inch end), and with the 0 end lightly touching the catcher's index finger. When ready, the dropper will release the ruler without telling the catcher. The catcher will catch it with their thumb and forefinger as soon as they see it dropping, as fast as possible when the dropper lets go of it. The catcher will record the number where they caught the ruler at the top edge of their finger.

Optional Tests:
Auditory Test: The catcher will close their eyes and the dropper will say 'Drop' when they let go of the ruler, so the catcher will only *hear* the cue.
Tactile Test: The catcher will close their eyes and the dropper will touch them on the shoulder at the same moment they drop the ruler as a cue to catch the ruler, so the catcher will know to catch by *touch*.

5. Give the word for each team to begin when they are set to go.
6. After each team member has performed all their trials, have them find their reaction times in the chart below, based on their ruler measurements, and then fill in their tables in their notebooks.

Reaction Time Chart

cm distance	*seconds*	cm distance	*seconds*	cm distance	*seconds*
1	*0.05*	11	*0.15*	21	*0.21*
2	*0.06*	12	*0.16*	22	*0.21*
3	*0.08*	13	*0.16*	23	*0.22*
4	*0.09*	14	*0.17*	24	*0.22*
5	*0.10*	15	*0.18*	25	*0.23*
6	*0.11*	16	*0.18*	26	*0.23*
7	*0.12*	17	*0.19*	27	*0.24*
8	*0.13*	18	*0.19*	28	*0.24*
9	*0.14*	19	*0.20*	29	*0.24*
10	*0.14*	20	*0.20*	30	*0.25*

The chart is based on the following formula, $t = \sqrt{2d / g}$, where d = the distance the ruler fell in cm, g = the acceleration of gravity (9.8 m/s^2), and t = the time the ruler was falling (seconds).

WHAT IS GOING ON HERE?

When the ruler is dropped, your eyes see it, but it takes time for the nervous system to send that information to your brain. Then, your brain needs to process it and decide what to do. In this case—grab it! A signal is sent to your hand, and the muscles contract, allowing you to catch the object.

FURTHER EXPLORATION

- Have students do the optional tests – auditory and tactile - and see whether their reaction times are faster using one sense rather than another.
- Have students try more than one sense – visual and auditory, visual and tactile, or all three senses - and explore whether their reaction times change, improve, or decrease using more than one sense.
- Have students try more trials to see how repetition affects reaction time. Look for trends of increasing reaction time due to fatigue or some other factor.
- Ask students to think of questions they have about reaction times and how their brain processes and responds to information from their senses. Ask them to design an investigation to answer their questions. Use class time for their investigations.