Stimulus-Response Lab – Comparing reaction time between senses

SC Standards 7-1: The student will demonstrate an understanding of technological design and scientific inquiry, including process skills, mathematical thinking, controlled investigative design and analysis, and problem solving.

7-1.1 Use appropriate tools and instruments (including a microscope) safely and accurately when conducting a controlled scientific investigation.
7-1.3 Explain the reasons for testing one independent variable at a time in a controlled scientific investigation.
7-1.4 Explain the importance that repeated trials and a well-chosen sample size have with regard to the validity of a controlled scientific investigation.
7.1-5 Explain the relationship between independent and dependent variables in a controlled scientific investigation through the use of appropriate graphs, tables and charts.

SC Standards 7-3: The student will demonstrate an understanding of the functions and interconnections of the major human body systems, including the breakdown in structure or function that disease causes.

7-3.2 Recall the major organs of the human body and their function within their particular body system.

NGSS Science and Engineering Practices

- Using mathematics and computational thinking
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information
- Analyzing and interpreting data

Concept: Stimulus and Response

Hook: Which sense do you think is faster: visual, auditory or tactile? Give examples.

Macro: The instructor discusses students' response and the variables that may affect reaction time. The instructor will ask which one of the five senses is faster at responding to stimuli. The instructor tells the students that they will be collecting reaction time data using three senses. Students will be asked to formulate a hypothesis before they begin the experiment.

Model: Students will be working in pairs to measure reaction time using a ruler and a converting chart. Comparisons will be made between three senses: visual, auditory and tactile. Students will be asked to average their individual data and create a graph comparing the senses and individual variability.

Materials

- Meter sticks
- Calculators

Symbolic: The following terms will be introduced:

Stimulus: Internal or external change that causes a response.

Response: A reaction caused by a stimulus.

Reaction time: The interval of time between application of a stimulus and detection of a response.

Hypothesis: My fastest sense is _____.

Procedure

1) You will be working in pairs: one person will hold the top of the ruler (near the highest number) and the other person will place his/her fingers just below the 0 mark on the ruler, but not touching the ruler.
2) The ruler will be dropped and your partner must try to catch it as fast as possible. Record the distance the ruler traveled in centimeter (cm).
3) Repeat the procedure 4 times for a total of 5 times and record your data.
4) Now repeat the procedure 5 times with each modification and record your data:
    1) Persons catching the ruler have their eyes closed. Persons dropping the ruler are going to say 'Drop' as they release it.
    2) Persons catching the ruler have their eyes closed. Persons dropping the ruler are going to slightly touch their partners as they release it.
5) Switch function and repeat the procedure. Record the data.
6) Average yours and your partner's data.
7) Convert your average centimeters data into time in seconds using the given conversion chart. If the average centimeters are not listed on the chart, you can calculate it using the following formula: $t = \sqrt{[2(cm)/980]}$.
8) Make a graph.

Table 1. Reaction measured in centimeters.

	Reaction in cm					
	Subject 1			Subject 2		
Trial	Visual	Auditory	Tactile	Visual	Auditory	Tactile
1						
2						
3						
4						
5						

Table 2. Average reaction in centimeters.

Subject 1			Subject 2		
Visual	Auditory	Tactile	Visual	Auditory	Tactile

Converting Chart

Centimeters	Time (seconds)	Centimeters	Time (seconds)	Centimeters	Time (seconds)
3.0	0.08	10.0	0.14	17.0	0.19
4.0	0.09	11.0	0.15	18.0	0.19
5.0	0.10	12.0	0.16	19.0	0.20
6.0	0.11	13.0	0.16	20.0	0.20
7.0	0.12	14.0	0.17	23.0	0.22
8.0	0.13	15.0	0.17	25.5	0.23
9.0	0.14	16.0	0.18	30.5	0.25

Table 3. Reaction converted from centimeters to seconds.

Reaction time in seconds					
Subject 1			Subject 2		
Visual	Auditory	Tactile	Visual	Auditory	Tactile

Graph yours and your partner's results in seconds!! Make sure to include labels with units and a title.

Analysis Questions – Restate the question and write down your answers. Make sure to number your answers.

1) Which one is the independent variable and how do you know?
2) Which one is the dependent variable and how do you know?
3) Which of your senses was faster? Did you accept or reject your hypothesis?
4) What variables were controlled?
5) How could we make this experiment better?
6) Explain what processes happened in your body in order for you to catch the ruler.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____ Block: 1 2 6 7

Pre-Quiz

1. Explain what happened to the nervous system in the picture above. Try using the terms stimulus and response.

2. Identify the stimulus.

3. Identify the response.

Name: _____ Block: 1 2 6 7

Post Quiz

1. Explain what happened to the dog's nervous system in the picture above. Try using the terms stimulus and response.

2. Identify the stimulus.

3. Identify the response.