THINK FAST!

Testing Reaction Times

HERE'S WHAT YOU'LL NEED:

- Ruler or meter stick
- A partner
- A flat table or desk top
- A chair
- A notebook

WARM-UPS

Sit in a chair and rest your arm on a table so your wrist is over the edge.

Have a partner hold the ruler vertically so the end closest to the 0 cm side hangs evenly between, but not touching, your thumb and index finger.

Without giving prior warning, your partner should release the ruler. Catch it between your fingers as soon as you see it drop.

Measure the distance to the nearest centimeter between the bottom of the ruler and the top of your thumb. Record it in your notebook.

Repeat at least five times.

Communicate your distance data by plotting the points in a line or bar graph and summarize your findings.

Switch places with your partner and repeat.
Remember to record the data and graph their results.

Compare your graph with your partner's.

What are some possible causes for a difference in the numbers?

Calculate your average catch distance:

$$\text{average catch distance} = \frac{\text{sum of all the distances}}{\text{total number of trials}}$$

GAME TIME

Let's investigate how distractions can affect your catch distance.

You are going to use the same arm and ruler position that you did in the warmups, but this time you are going to add the distraction of reciting the alphabet during the drop.

Sit in a chair and rest your arm on a table so that your wrist is over the edge. Start reciting the alphabet.

Have a partner hold the ruler vertically so the end closest to the 0 cm side hangs evenly between, but not touching, your thumb and index finger.

Start reciting the alphabet out loud.

Without giving prior warning, your partner should release the ruler.

Catch it between your fingers as soon as you see it drop.

Measure the drop distance to the nearest centimeter and record it in your notebook.

Repeat at least five times.

Calculate your average catch distance.

Switch places with your partner and repeat.

Did you find the alphabet distracting? How did it affect your average catch distance?

Let's try the reaction time test using a letter of the alphabet as a drop cue.

Follow the same procedure, but instead of dropping the ruler without warning, this time your partner will release it when you get to the letter "G."

Based on your previous experience, make a prediction about how the cue will affect your catch distance?

Once you've finished testing, don't forget to create a graph or table with the new data you have collected to help you look for patterns and analyze your results.

Review all of the information you have collected through your trials and observations.

Did your drop trials have the outcomes you expected?

Which variable (non-distracted, distracted or cued) produced the shortest catch distance? Use the evidence found in your data to support why you think it worked the best.

Based on what you've learned:

Would basketball players calling out warning cues to each other help or hinder a teammate's ability to catch the ball?

How would texting or eating while driving affect a person's ability to react to changes in traffic?

Investigate other factors to determine how they affect your catch distance.

Possible variables to try:

Dominant hand (the one you write with) versus the non-dominant hand

Athletes versus non-athletes

Older people versus younger people

Girls versus boys

DO YOU WANT TO LEARN MORE?

Research:
Reaction Time, Response Time, Gravity, Neuroscience, Sensory-Motor Integration, Eye-Hand Coordination

You can use your average catch distance to find out how long it takes you to actually catch the ruler. We call this reaction time. Most people's reaction time in the ruler test is usually less than a second.

CHECK OUT THESE WEBSITES TO TEST YOUR REACTION TIME IN DIFFERENT CHALLENGES

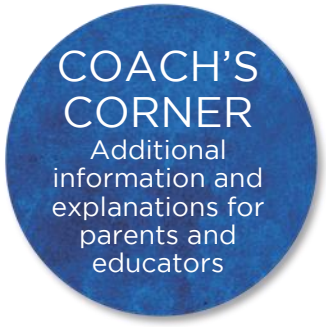
Play the Sheep Dash Game to test your reaction time:
http://www.bbc.co.uk/science/humanbody/sleep/sheep/reaction_version5.swf

A Click Reaction Time Test
http://www.humanbenchmark.com/tests/reactiontime

CHECK OUT THESE WEBSITES FOR EXERCISES AND TIPS TO IMPROVE YOUR REACTION TIMES

Cat Like Reflex Training Methods! (exercises to improve reaction times)
http://www.bodybuilding.com/fun/bioplyo2.htm

4 Easy Drills to Improve Hand-Eye Coordination
http://www.outsideonline.com/1959876/4-easy-drills-improve-hand-eye-coordination



You can use the average distance your ruler fell to find out how fast your reaction time is.

Reaction time is the interval of time it takes for a person to detect and then react to a specific stimulus.

In this case, the reaction time interval begins when your eyes recognize the stimulus of the ruler falling. When your eyes detect movement, information travels from sensory cells, or neurons, in the eye to the visual cortex, the portion of the brain responsible for processing visual information.

From there, the signal travels to the motor cortex, the part of the brain that directs movement. It sends signals along the spinal cord and to the muscles in your arm, hand and fingers and directs them to move in the proper sequence to catch the falling ruler. Even though a lot of coordination and communication has to happen inside your nervous system before it responds to a stimulus, it is accomplished very quickly, most often in less than half a second.

You can use the chart below to find your reaction time:

AVERAGE DISTANCE (cm)	REACTION TIME (sec)
1	.045
2	.064
3	.078
4	.090
5	.101
6	.111
7	.120
8	.128
9	.136
10	.143
11	.150
12	.156
13	.163
14	.169
15	.174

AVERAGE DISTANCE (cm)	REACTION TIME (sec)
16	.181
17	.186
18	.192
19	.197
20	.202
21	.207
22	.212
23	.217
24	.221
25	.226
26	.230
27	.235
28	.240
29	.243
30	.247

WHERE DID THE REACTION TIMES ON THE CHART COME FROM?

Start with the formula to find the distance an object will fall in a given amount of time:

$$d = \frac{1}{2}at^2$$

d = the ruler's vertical drop distance in centimeters
a = acceleration of gravity, which is a constant rate of 9.8m/s2
t = reaction time

Rearrange the equation to solve for t:

$$t = \sqrt{\frac{2d}{a}}$$

Plug in distance data (d) from the test drops, 9.8m/s^2 for gravity (a) and solve for time.

A person's reaction time can vary considerably for different tasks and even the same task under different conditions. A major factor that influences reaction time is the number of potential stimuli that are present at any one time because each requires its own response. If there is only one thing for the nervous system to respond to, it takes a shorter time to react. If there are several possible stimuli to respond to, the brain must select which response to carry out first.

Slower reaction times often have negative consequences. A recent study by the Texas Transportation Institute and Texas A & M University[1] found that reaction times doubled when drivers were distracted by reading or sending text messages. A second study by the Virginia Tech Transportation Institute[2] found that text messaging, browsing and dialing resulted in drivers taking their eyes off the road an average of 23 seconds.

A person's reaction time is an inherent ability, which means each individual has a genetic built-in limited time range to react to stimuli. But, within those boundaries, practice and experience can shorten those times. Practice makes the brain's decision-making more efficient by helping to eliminate some potential response selections. Once a response is practiced enough, the nervous system becomes familiar with it and it reacts automatically. Walking, running and riding a bicycle are good examples.

OKLAHOMA STANDARDS			
Mathematics		4th grade	5th grade
PS 1.1	Problem solving	●	●
PS 1.3	Dev/Test/Apply	●	●
PS 1.4	Verify/Interpret		●
PS 3.1	Pattern Relationship	●	●
PS 3.2	Thinking Processes	●	
PS 3.3	Making Predictions	●	●
PS 5.1	Representations	●	●
PS 5.2	Representations	●	●
S 5.1.a	Data Analysis		●
S 5.1.b	Data Analysis	●	●
S 5.2	Probability	●	
Science			
4-LS1-2	Molecules to Organisms	●	

[1]An Investigation of the Effects of Reading and Writing Text-Based Messages While Driving
http://d2dtl5nnlpfr0r.cloudfront.net/swutc.tamu.edu/publications/technicalreports/476660-00024-1.pdf

[2]New Data from VTTI Provides Insight into Cell Phone Use and Driving Distraction
http://opi.mt.gov/pdf/DriverEd/RR/09VTTI_CellPhonesDistraction.pdf

Updated Study Shines New Light on Phone Use While Driving
http://www.vt.edu/spotlight/achievement/2013-07-01-distracted/texting.html