



Reaction Time with Dr. Manal Fakhoury



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EACH TEAM will need:

- White board for group discussion
- A means for showing videos in the classroom
- Yardsticks or rulers (one per team of two students)
- Timers (students can use their cell phones)
- Data Collection Sheet (one per student - available in down-loads)
- Clip board (one per team, if available, for the data collection sheets)
- Pencils

Optional:

- Candy bars for candy bar experiment (candy bar replaces yard-stick to study how reaction time changes with motivation, if they get to keep the candy bar)
- Deck of cards (one per team)
- Whistle (one per class)
- Squishy balls (one per team)

I. IMPORTANCE OF TEAM WORK (2-3 minutes)

Experiment Rules: (1-2 minutes)

- Be Polite
- Work Together
- Participate
- Raise hand to ask question
- Take Notes
- Keep work area clean
- Have fun

II. INTRODUCTORY GAMES

Tag your Partner's Knee (video available from downloads). Show the video, and have the class pair up and do this experiment. Do this for fun, no data collection is required.

Cell phone reaction time. Show video, available from downloads.) Repeat cell phone demonstration with two volunteers from the class.

III. REACTION TIME EXPERIMENT

1. Definition: What is reaction time?

The time needed to respond to a stimulus or situation

The **speed** at which we are able to **process information and make decisions**.

When you have advance notice that you are going to need to respond, your reaction time is faster. In other words, when you are **alert**, you have a faster reaction time.

Why is this important?

It often determines our success, for example in:

- Sports
- Test taking
- Safety (for example, driving)

Reaction time has 3 main components:

- Reaction Time
- Movement Time
- Response Time

Reaction Time: is the time from a stimulus occurring to the performer starting to move in response to it.

Example: Sprinter hearing the gun shot. The gun is the stimulus.

Movement Time: A little different. Movement time is the time from starting the movement to completing it.

Response Time: Reaction time plus movement time. Response time is the time from the stimulus occurring to the completion of the corresponding movement.

Response time is the time it takes the nerve impulse to move from your eyes to your brain (reaction time) and then from your brain to your muscles (movement time).

Distractions increase reaction time while driving because you are not as alert to possible situations on the road.

We all have a **measurable reaction time**.

Reaction time is affected by distractions.

Reaction time without distractions is about 0.12s

Distractions increase reaction time while driving because you are not as alert to possible situations on the road.

How is it important? Ask for examples.

2. Factors That Influence Reaction Time

Age

Practice

Fatigue

Exercise

Overall health

Heredity (genetics)

Sensory system - sight vs touch

Gender - males are generally faster

Limb used

Personality - outgoing vs shy

Body temperature - warmer is faster

Alertness level - excited vs lethargic

3. Distractions: Give examples.

Sneezing

Bad Weather

Sudden changes on your windshield

What are some distractions that can be avoided?

Does everyone have the same reaction time?

4. Basic Reaction Time Experiment.

The Ruler Drop Test - How Fast Are You?

Show the video (Mr. O) from the downloads to provide visual instructions for the experiment to the students.

This activity is designed to measure your **response time** to something that you see.

Get a ruler or a yardstick. Yardsticks, if available, are better, especially for younger students who may have slower reaction time. Hold the ruler near the end (highest number) and let it hang down. Have another person put his or her hand, resting on a desk or table, aligned with the bottom of the ruler and have them ready to grab the ruler as it drops. **(They should not be touching the ruler).**

Tell the other person who you will drop the ruler sometime **within the next 5 seconds** and that they are supposed to catch the ruler as fast as they can after it is dropped. Record the level (**inches or centimeters**) at which they catch the ruler (you can convert the distance into reaction time with the chart below). Test the same person **3 to 5 times** and record the results on the worksheet provided. (Vary the time of dropping the ruler within the 5 second "dropzone" so the other person cannot guess when you will drop the ruler).

Use the table provided with the worksheet to convert the distance on the ruler to reaction time. For example, if you caught the ruler at the 8 inch mark, then your reaction time is equal to 0.20 seconds (200 ms). Remember that there are 1,000 milliseconds (ms) in 1 second.

Older students should be careful to hold their hand in exactly the same way for each trial, and the same as the other students in the class - with the same amount of separation between the fingers and the thumbs. For younger students, this level of accuracy is not important.

Older students can interpolate the correct reaction time from the table, younger students can choose the closest distance to what they recorded.)

See Table of Distance and Reaction Time on the Downloads page.

GETTING STARTED

Step 1: What is your hypothesis?

(Examples - the subject will have a fast reaction time, or a faster than average, all students will have similar reaction time, etc.)

Step 2: Conduct the experiment

1. Have your subject rest their hand on the table
2. Hold a ruler at the top edge.
3. Have the subject put their thumb on one side of the bottom of the ruler and their fingers on the other side. They should not grasp the ruler though. It must be able to freely fall between his fingers.
4. Without warning the subject, let go of the ruler.
5. When the subject notices that the ruler is falling, they should try to grasp it by closing his thumb and fingers around it. They should not move their hand.
6. Look at the ruler and see where the subject grasped it. Find the location in centimeters on the ruler where the hand is grasping the ruler. This should tell you how far the ruler fell before the subject reacted and grasped the ruler.
7. Record the location of the grasp on your sheet.
8. Repeat steps 1 through 7 two more times for this subject.
9. Repeat the whole procedure (steps 1 through 8) with additional subjects.

Step 3: Record and Organize Data

Use the provided data sheet, available from downloads

After each trial, the subject records their own data on the worksheet. After all trials for each group member have been completed, the students will convert their measurements to their to reaction time using the provided data conversion chart.

Step 4: Draw Conclusions and Present Results

Now look at your results. What do they tell you about your hypothesis? This is your conclusion. Generally, there are three possible conclusions:

My hypothesis was correct

My hypothesis was incorrect

I'm not sure if my hypothesis was correct or incorrect

Each group presents their results to the class.

(OPTIONAL)

Compare boys vs. girls. On average, are the boys or girls faster?

Compare the scores after practice. Does reaction time improve with practice?

Calculate time with distraction and non-distraction. For this experiment, have the person holding the ruler distract the subject by making funny noises, or making faces, or singing a song, snapping their fingers, etc. before and/or while dropping the ruler.

Have each group present their results.

Other variations: There are many variations of the ruler drop test, including blindfold / tactile (where you touch their shoulder and then drop the ruler while they are blindfolded), warning vs no-warning, two rulers (one for each hand).

ADDITIONAL REACTION TIME EXPERIMENTS

Whistle Experiment:

Ask for a boy and girl volunteer to come up to the front.

Stand behind them.

Blow the whistle and see who reacts faster by raising their hand. Do it several times.

Simple or Multiple Choice Reaction Time, Card Experiment:

Simple - There is only one response to a given stimulus, no decision making.

Multiple Choice - There is more than one stimulus and or there is more than one response. The greater the number of possibilities, the more time it takes for someone to react.

Card experiment can be done in several phases.

1. All cards in the deck are in a single facedown stack, measure the time it takes to flip them over, one by one. (simple).
2. All the cards are face down, measure the time it takes to flip them over and separate into the two colors. (choice)
3. All cards are face down, separate into suits (four stacks).
4. All cards are face down, separate into suits and face cards (five stacks).

You would expect to see the biggest reaction time between #1 and #2, when you move from simple to multiple choice. Have students specify their hypothesis before beginning.

How do athletes improve their reaction time:

Squishy ball practice, see download videos for instructions.

Have students try the various ways to practice.

DOWNLOADS

Conversion of distance measured with ruler to Reaction Time

DISTANCE		REACTION TIME
2 in	5 cm	0.10 sec (100 ms)
4 in	10 cm	0.14 sec (140 ms)
6 in	15 cm	0.17 sec (170 ms)
8 in	20 cm	0.20 sec (200 ms)
10 in	25.5 cm	0.23 sec (230 ms)
12 in	30.5 cm	0.25 sec (250 ms)
17 in	43 cm	0.30 sec (300 ms)
24 in	61 cm	0.35 sec (350 ms)
31 in	79 cm	0.40 sec (400 ms)
39 in	99 cm	0.45 sec (450 ms)
48 in	123 cm	0.50 sec (500 ms)
69in	175 cm	0.60 sec (600 ms)

(Conversions between inches and centimeters are approximate)

Tag your partners knee

<https://pedl.uoregon.edu/tag/knee-tag/>

Cell phone demo

<https://www.youtube.com/watch?v=--PYGAyM05E>

Mr. O and the yardstick/ruler test

<https://www.youtube.com/watch?v=MRosXclyNG4>

Data sheet for yardstick/ruler test

<http://www.the-science-mom.com/wp-content/uploads/2012/03/reaction-time-test-data-log-sheet.pdf>

Improving your Reaction Time

<https://www.youtube.com/watch?v=R42rz4DIYDA>

DO MORE/LEARN MORE

Compare your reaction time to visual stimulus to that of a university ath-lete, doing 3 simple tests with computer-https://www.youtube.com/watch?v=e0TAR4d_FdM

Improving reaction Time with Practice: Have your class practice with the squishy ball every day for ten or fifteen minutes, for some number of days. Then repeat the yardstick/ ruler experiment, collect data, calculate, and see whose reaction time improves. Before beginning the daily practice, have students record their hypothesis.

Dollar experiment - This is another alternative to yardstick / ruler. It seems like it will be easy, but it turns out that very few people can catch the dollar, because the dollar is shorter in length than what is needed to accommodate the average person's reaction time.

<https://www.youtube.com/watch?v=7PXxHsl29cQ>

Reflex Test

<https://www.youtube.com/watch?v=CbR1298JVjQ>

Reaction Time Intro - Drugs (For older students)

<https://www.youtube.com/watch?v=Ez4-Dt9AQQg>