

LEARNING ACTIVITY II:

How Quick Are Your Responses?

OVERVIEW

In this activity, students will learn what reaction time is and how it is measured.

SCIENCE & MATHEMATICS SKILLS

Observing, collecting and recording quantitative data, calculating averages, drawing conclusions

PREPARATION TIME

10 minutes

CLASS TIME

50 minutes for each of two parts

MATERIALS

Each group of students will need:

- Ruler
- Scissors
- Pen or pencil
- Meter stick
- Note pad

BACKGROUND

When the sleep/wake cycle is disrupted, people can become fatigued and may not perform as well as they usually do in a variety of situations. This activity will allow students to learn about reaction time (the time interval between the presentation of a stimulus and the body's voluntary reaction to that stimulus) and how reaction time might be affected by lack of sleep.

A Reaction Time Test will be used as a means of determining the time it takes to react or respond to a given/presented stimulus. Usually, such tests are performed multiple times to account for the normal range of variation in measurements. In Neurolab, a computerized test determined astronauts' reaction times accurately. The corresponding test to be used on Earth depends on gravity and will not work in the weightless environment of space.

Reaction times can vary even for the same individual, because when subjects are tired, reaction times can be longer. This lesson focuses on the normal range of reaction time, how it is measured, and how it varies with alertness level.

MAJOR CONCEPTS

- Reaction time can vary even for the same individual.
- When subjects are tired, reaction time can be slower.



PROCEDURE

Part One: Learning to Measure Reaction Times

Have students work in pairs to do the following activity:

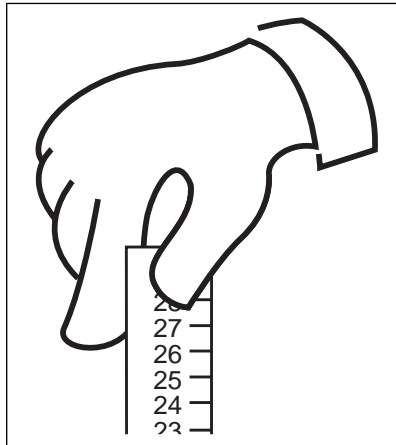


Figure 99 Diagram of the forefinger and thumb position.

1. Before beginning, have each student assess, on a scale of one to ten, how sleepy they are—with “1” being not at all sleepy, “5” being somewhat sleepy and “10” being ready to fall asleep instantly.
2. Within each team, have one student hold a ruler with centimeters (between the thumb and forefinger) vertically at the 30 cm mark with the 0 mark toward the floor (Figure 99).
3. Instruct the student’s partner to position his/her forefinger and thumb at the 0 cm end of the ruler without touching it, so that he/she will be able to grab the ruler easily by closing his/her finger and thumb together (Figure 99).
4. Tell the partner to observe the ruler carefully and then have the first student release the ruler.

Reaction Times

Release #	Result
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
11	_____
12	_____
13	_____
14	_____
15	_____
16	_____
17	_____
18	_____
19	_____
20	_____
Average	_____

Figure 100 Example of chart for recording reaction times.

5. Direct the partner to close his/her thumb onto the ruler to stop it as soon as the ruler moves.
6. Have the student mark the place where the partner’s fingers were when he/she stopped the ruler. The student should discard the first result if the ruler moved less than five centimeters.
7. Have the students repeat the release/catch process 20 times and record and average the results on a chart (Figure 100).
8. Have the students change places so that all will have an opportunity to do this activity.
9. As a class, plot the average values of each student’s reaction times as a histogram, as shown in Figure 101. Have students think about what really is being measured in the activity, and how distance in centimeters reflects reaction times.
10. Have students calculate the average value of their reaction times and the average value of their sleepiness scores. To do so, add the values together and divide the sum by the number of values.
11. Ask the students to identify the normal range of reaction times in their class population. Example: If sleepiness score is a “3” and the average reaction time is ____, add 3 + ____ and divide the sum by ____ (number



of values.) Discuss reaction time variance and alertness level. Ask the students about the times when distances less than 5 cm occurred during the trials. Why was it important to discard these results?

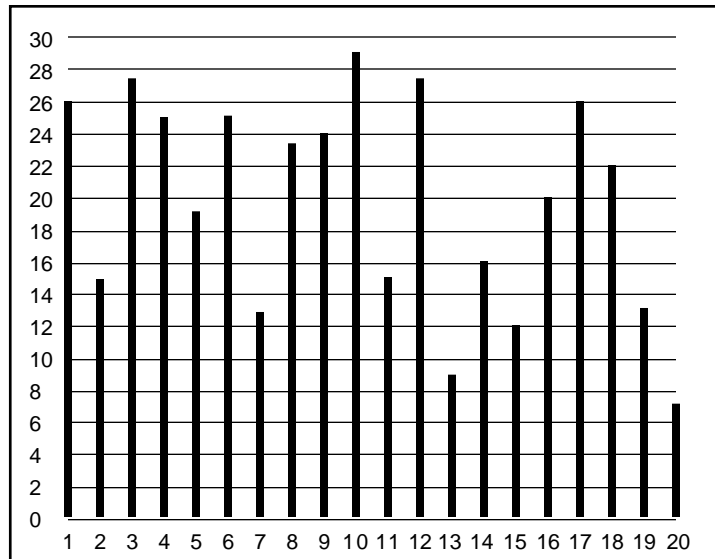


Figure 101 Example of histogram of the values of students' reaction times.

Part Two: The Effects of Being Tired on Reaction Times

This exercise is designed to test the students' reaction times after they are feeling tired. Have students follow the steps below in order to obtain accurate results.

1. Have each student take a ruler home.
2. Inform students that they will need to ask someone at home to help them with this activity, and suggest that the students perform this activity on a Friday or Saturday night so as not to disrupt their weekly routines.
3. Have students ask their parent(s)/guardian(s) for permission to stay up one or two hours beyond their normal bed time. (Remind the students that their partners also will have to stay up.)
4. Instruct students to perform 20 trials of reaction times tests before they go to bed. Inform them that they must be feeling tired and ready to go to bed before doing this exercise. (Ask students to evaluate how sleepy they feel using the same scale as in the previous activity.)

5. Direct the students to repeat the activity after they have each had a good night's sleep. (Again, ask them to evaluate how sleepy they feel using the same scale as in the previous activity.)
6. Have students calculate their average reaction times during each trial (night and morning).
7. Compile another set of class averages and a histogram (Figure 101) as before. Have students discuss the results. Have them think about and discuss the physical and mental symptoms of being tired and how these might have affected their reaction times.

Evaluation

Students should now have some understanding of how lack of sleep or fatigue can influence their abilities to respond quickly.

REVIEW QUESTIONS

1. What happens to reaction time when one is sleepy or tired?

Reaction time is slower.

2. What are physical signs of being tired?

What are mental signs of being tired?

One physical sign of being tired is inaccurate motor coordination.

A mental sign of being tired is lack of concentration.

THINKING CRITICALLY

1. Ask the students whether or not the sleepiness scores were greater just before going to bed or in the morning.
2. Ask the students whether or not reaction times were longer in their tests performed just before going to sleep or in their tests done in the morning at school.
3. Discuss with the students what would happen if one was not allowed to sleep for the whole night, and then performed the reaction time test. (Make sure students understand they should NOT do this!)
The reaction time would become slower if there were no sleep during the whole night.

SKILL BUILDING

1. Have students conduct a survey of family and friends by asking them to report their sleepiness scores throughout a 24-hour cycle. Are any general trends obvious among all persons surveyed. When are most people alert? When are most people sleepy? How could this information be used to design job or school schedules?

