**Subject area/course**: Science

**Grade level/band**: 9-12

**Task source**: SCALE/New York City DOE; Author: Michal Lomask

**Which Factors Affect Your Reaction Time?**

**STUDENT INSTRUCTIONS**

1. **Task context**:

Reaction time is the ability to respond quickly to a stimulus. It is important in many sports and in day-to-day activities. Choice reaction time is the time taken between stimulus and action, which requires a choice (e.g., starting to run a race after hearing the start command). Choice reaction time can be improved by practice and training.

In a basketball game, for example, a quick reaction time is a big advantage. The players receive stimuli from the eyes (e.g., position of other players, the ball etc), the ears (e.g., calling from players, the referee, even spectators), and kinesthetic sense (e.g., the performer's position, their options etc). Skilled players reduce reaction time by selecting the most important information, and by anticipating other players’ actions and the path of the ball quickly.

1. **Final product**:

In this science task you will learn how to measure reaction time and then you will explore how various factors affect the reaction time of you and other students in class. The investigation will be done in small groups of 3-4 students each. At the end of Inquiry lab you will have to write your own lab report, therefore make sure you record accurately the experiment procedures and the data that was collected.

**Activity I – Guided Lab: Learn how to measure reaction time**

Read and follow the instructions to learn how to use the ruler for measuring reaction time:

* The “subject” (the one that is tested) tucks his/her elbow to the waist and extends the wrist forward; with the thumb and index finger open about 4cm apart.
* The “researcher” holds the ruler vertically in the air between the subject’s thumb and index finger, and aligns the ruler so that the zero mark is exactly between the subject’s fingers.
* Without warning, the researcher releases the ruler and let it drop - and the subject must catch it as quickly as possible.
* The “recorder” records the distance the ruler fell, in cm, in the data table below.
* Repeat the experiment at least five times with each student and record the results.
* Calculate the **average distance** for each student and write it down in the table on the next page.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Student A | Student B | Student C | Student D |
| Trial 1 |  |  |  |  |
| Trial 2 |  |  |  |  |
| Trial 3 |  |  |  |  |
| Trial 4 |  |  |  |  |
| Trial 5 |  |  |  |  |
| Average distance |  |  |  |  |
| Average reaction time |  |  |  |  |

The Distance/Time Conversion Table below shows the relationship between the distance the ruler dropped in cm and the reaction time in seconds (the conversion is based on the formula of Free Fall D= 1/2gt2, where D = distance in meters, t=time in seconds and g is the gravitational acceleration -9.8 m/s2.). Use the chart below to convert the average distance to average reaction time for each of the students in the group and record the data in the table above.

**Distance/Time Conversion Table**

|  |  |
| --- | --- |
| **Distance Ruler Dropped**  **(in centimeters)** | **Reaction Time**  **(in seconds)** |
| 1 | .05 |
| 2 | .07 |
| 3 | .08 |
| 4 | .09 |
| 5 | 0.10 |
| 10 | 0.14 |
| 15 | 0.18 |
| 20 | 0.20 |
| 25 | 0.23 |

**Data interpretation:**

* Share your findings with the class and compare findings of different groups.
* Are your results similar or different? What might explain these differences?

**Activity II – Inquiry Lab: Explore Factors Affecting Reaction Time**

With your group, follow these steps:

1. Talk about different factors that may affect your reaction time and as a group decide on ONE factor to explore. Write it in a form of a testable question [e.g., how does X (insert your factor in place of X) affect students’ reaction time?].
2. Write a relevant hypothesis to your question [e.g., I think that X will increase/decrease reaction time because (provide explanation)].
3. Identify relevant variables and design controlled experiment to answer your question.
4. Conduct your experiment and record your findings in an organized data table that includes both the distance on the ruler (in cm) and the reaction time (in seconds).
5. Draw data-based conclusions about the impact of the factor you have investigated on the reaction times of students in your group.
6. Identify things that did not work well and think about how you can improve your experiment if you have to do it again.
7. During this activity keep accurate records of procedures, findings and any other ideas you have regarding this topic.

**Additional Information**

1. **Knowledge and skills you will need to demonstrate on this task:**

See student directions and description of final product/task. Note this summary of what you must demonstrate:

“In this science task you will learn how to measure reaction time (session 1) and then you will explore how various factors affect the reaction time of you and other students in class (session 2). The investigation will be done in small groups of 3-4 students each. At the end of Inquiry lab you will have to write your own lab report (session 3), therefore make sure you record accurately the experiment procedures and the data that was collected.”

1. **Materials needed:**
2. 30-cm metric rulers
3. Graph paper (image of graph paper is provided at the end of the lab report)
4. Calculators (optional)
5. Stopwatches (optional)
6. Any additional materials needed for the task designed by students.
7. **Time requirements:**

This task is designed to take place over four 45-minute long sessions. Your teacher will provide you with more information about the timing of each part of the task.

1. **Scoring:**

Your work will be scored using the Scientific Inquiry/Process Skills rubric. You should make sure you are familiar with the language that describes the expectations for proficient performance.