**Investigating Motion**

**Materials Needed:** Stop watches, meter sticks, tape and 5 meters of walking space are needed.

**Time:** 1 class period (45-60 minutes) for the data collection and 1 class period for the write-up.

**Students:**  Groups of 5 work best, but this can be adapted.

**Problem:** How does position affect how we view the motion of an object?

**Science Question:**  Will your position as observer effect how you see an object move?

**Hypothesis:** If I observe a walker from different positions, then the motion of the walker will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure:**

1. Measure a track that is 5 m long. Place tape at the start line and at the finish line. The track should be about 1 meter wide.
2. There will be four observers and one walker. Don’t worry! Everyone will have a chance to walk!
3. All observers should have a stopwatch, a pencil, and a copy of the student data sheet.
4. Place the observers as follows:
   1. One observer should be behind the start line.
   2. One observer should be behind the finish line.
   3. One observer should be in the middle of one sideline.
   4. One observer should be in the middle of the other sideline.
5. The walker should be at the start line. The walker should walk at about the same pace each time. Operational Definition: Since the pace needs to be as constant as possible for each walker, use a beat such as 1-2-3, to make sure that all group members walk at about the same pace.
6. Each observer should start his or her stopwatch when the walker starts moving and stop when the walker reaches the finish line.
7. The walking group member will only collect data when he/she is observing.
8. The group should repeat steps 5-6 for 3 trials.
9. Immediately after the 3rd trial, each observing group member should draw a diagram in the appropriate box and briefly describe in words, the motion of the walker from their own frame of reference (FOR).
10. Rotate positions. The walker becomes an observer and each observer moves to a different position.
11. Repeat steps 5-9 until all members of the group have been a walker.

**Data Collection:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Walking Time (s) | Starting Position | Finish Position | Right Sideline | Left Sideline |
| Trial 1 |  |  |  |  |
| Trial 2 |  |  |  |  |
| Trial 3 |  |  |  |  |
| Average Walking Time (s) |  |  |  |  |

|  |  |
| --- | --- |
| **Frame of Reference of the Observer** | **Observations: draw and label the motion of the walker** |
| **Starting Position (start line)** |  |
| **Finish Position (finish line)** |  |
| **Right Sideline (based on facing the start line)** |  |
| **Left Sideline (based on facing the start line)** |  |

**Analysis:**

1. **Look at the average walking times in your first data table.** 
   1. **Are the times for each FOR about the same or are they different? Explain your thinking.**
   2. **Should the times for each FOR be the same? Explain your thinking.**
   3. **If your times for each FOR were different, why were they different? Explain your thinking.**
2. **Look at your observations in your second data table. Did you see the exact same motion from each FOR? Why or why not? Explain your thinking.**
3. **Compare your data with others in your group. Explain some of the similarities and differences.**
4. **Identify the independent variable.**
5. **Identify the dependent variable.**

**Conclusion:**

1. **Make a claim that answers the science question: Will your position as observer effect how you see an object move? Support your claim using your quantitative data (time) and your qualitative data (observations).**
2. **Did your claim and evidence support your hypothesis? Explain.**