STEM Collaborative Cataloging Project

Stopwatch: Speed & Acceleration Lesson Plan

Context (InTASC 1,2,3)

Lesson Plan Created By: Heath Horpedahl
Created:
Lesson Topic: Speed & Acceleration
Grade Level: 6-7th Grade
Duration: 2 – 50 minute class periods
Kit Contents: http://odin-primo.hosted.exlibrisgroup.com/nmy:nmy_all:ODIN_ALEPH007783475

Desired Results (InTASC 4)

Purpose: The purpose of this lesson is to teach students the definition and formula to calculate speed and acceleration.

North Dakota Science Content Standards:

- Science Standards: Forces and Motion
  - PS.2A (Kindergarten) Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
  - MP.2 (PS.2: Kindergarten) Reason abstractly and quantitatively.

Objectives: Students will know and be able to solve the formula to calculate speed and acceleration.

Assessment Evidence (InTASC 6)

Evidence of meeting desired results: Students will accurately determine their own speed and acceleration using the stopwatches from the science kit.

Learning Plan (InTASC 4,5,7,8)

Instructional Strategy: (Check all that apply)

☑ Direct ☑ Indirect ☐ Independent ☑ Experiential ☑ Interactive

Technology Use(s): (Check all that apply)

☐ Student Interaction ☐ Align Goals ☐ Differentiate Instruction ☑ Enhance Lesson

☐ Collect Data ☐ N/A

Hook and Hold:

- Tell students about the NFL Draft and that one of the things scouts and coaches looked at is their 40 yard dash time. Tell the students they will be running their own 40 yard dash and figuring out their own speed, acceleration, & velocity. Show video "The Science of the NFL: Kinematics – Position, Velocity, & Acceleration.

Materials:

- Stopwatch Kit
- Calculators
- Yard Sticks
- Worksheet copies (below)
- ActiveBoard

- Projector with Sound

Procedures:

Day 1:

1. Put formulas for speed and acceleration on the board.
2. Hand out "Calculating Speed" worksheet (see below)
3. Go through at least one example for each type of formula listed. Have students take down any notes that may be helpful to them at the top of the page next to the formulas.
4. Assign worksheet for students to complete in class so you can be available to assist them.
5. At the end of class hand out "Kinematics – Speed, Velocity, & Acceleration – 40 Yard Dash Activity" to the students to read over so they are prepared for the next class period. Remind them to wear running clothes and find a partner by then.

Day 2:

1. Have stopwatches, yard sticks, and calculators set out and ready to go.
2. Quickly review expectations for behaviors while doing the 40 yard dash.
3. Head to your designated area to have students go through and complete the activity as the worksheet instructions say.
4. Go back to the classroom after and discuss/review formulas for speed, acceleration, & velocity.

Summary: Hand out "Review Speed" worksheet for students to complete as homework/final check of understanding.

Reflection (InTASC 9)

Reflect On:

- *Preparation*
- *Planning*
- *Teaching*
- *Student Engagement and Participation*
- *Evidence of Student Learning*

Standards

Council of Chief School Officers. (2011, April) *Interstate Teacher Assessment and Support Consortium (InTASC) model core teaching standards: a resource for state dialogue*. Washington DC. Retrieved from http://www.ccsso.org/documents/2011/intasc_model_core_teaching_standards_2011.pdf

North Dakota Department of Public Instruction. (2011) *North Dakota Science content standards.* Bismarck, ND. Retrieved from https://www.nd.gov/dpi/uploads/132/NDScienceStandardsDraftFormat2_Kindergarten_03APR14.pdf

This project was made possible in part by the Institute of Museum and Library Services. [SP-02-15-0044-15]

Calculating Speed, Time, Distance, and Acceleration

Equations:

Speed = $\frac{\text{Distance}}{\text{Time}}$ **Distance** = Speed x Time **Time** = $\frac{\text{Distance}}{\text{Speed}}$

Acceleration = $\frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Time}}$

Directions: Use the equation above to answer the following questions. Show your work and include the units.

1. A football field is about 100m long. If it takes a person 20 seconds to run its length, how fast (what speed) were they running?

2. What is the speed of a rocket that travels 9000 meters in 12.12 seconds?

3. What is the speed of a jet plane that travels 528 meters in 4 seconds?

4. What is the speed of a walking person in m/s if the person travels 1000m in 20 minutes?

5. The pitcher's mound in baseball is 85m from the plate. It takes 4 seconds for a pitch to reach the plate. How fast is the pitch?

6. If you drive 100km/hr for 6 hours, how far will you go?

7. If you run at 12m/s for 15 minutes, how far will you go?

8. Ever summer I drive to Michigan. It is 3900km to get there. If I average 100km/hr, how much time will I spend driving?

9. A bullet travels at 850m/s. How long will it take a bullet to go 1 km?

10. Every winter I fly to Michigan. It takes 5 hours. What is my average speed?

11. The fastest train in the world moves at 500 km/hr. How far will it go in 3 hours?

12. After traveling for 6 seconds, a runner reaches a speed of 10m/s. What is the runner's acceleration?

Now You Try It!

Come up with 5 of your own speed and/or acceleration questions. Use real world examples (riding bike, airplanes, cars, etc.) Make sure to include the answers!

Run the 40: 40 Yard Dash Activity

Materials:

- ✓ yard or meter stick
- ✓ stopwatch
- ✓ calculator

1. Measure out 40 yards with your partner.
2. Predict how long it will take to run a 40 yard dash.
3. Have one partner run a 40 yard dash. The other partner is the recorder.
4. After sufficient rest have the same student run another 40 yard dash.
6. Average the two run times and record in "Average Time" column.
7. Now calculate the speed of the runner. Divide the distance run by the average time. Use a calculator to get a precise value.

Speed = distance/time

	Run #1	Run #2	Average Time	Average Speed
40 Yard Dash Time				

1. Based on this information would you say that the runner has acceleration during the race? Describe it. (Do they speed up or slow down as the race goes on?)

2. Why is it necessary to have the same person time both races?

3. Reggie Bush is said to have run the 40 yard dash in 4.33 seconds. What is his speed in yards/second?

Review Speed, Time, Distance, and Acceleration

Equations:

Speed = $\frac{\text{Distance}}{\text{Time}}$ **Distance** = Speed x Time **Time** = $\frac{\text{Distance}}{\text{Speed}}$

Acceleration = $\frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Time}}$

Directions: Use the equation above to answer the following questions. Show your work and include the units.

1) What is the speed of a rocket that travels 9000 meters in 12.12 seconds?

2) What is the speed of a jet plane that travels 528 meters in 4 seconds?

3) What is the speed of a walking person in m/s if the person travels 1000 m in 20 minutes?

4) How far (in meters) will you travel in 3 minutes running at a rate of 6 m/s?

5) A football field is about 100 m long. If it takes a person 20 seconds to run its length, how fast (what speed) were they running?

6) If you drive at 100 km/hr for 6 hours, how far will you go?

7.) If you run a t 12 m/s for 15 minutes, how far will you go?