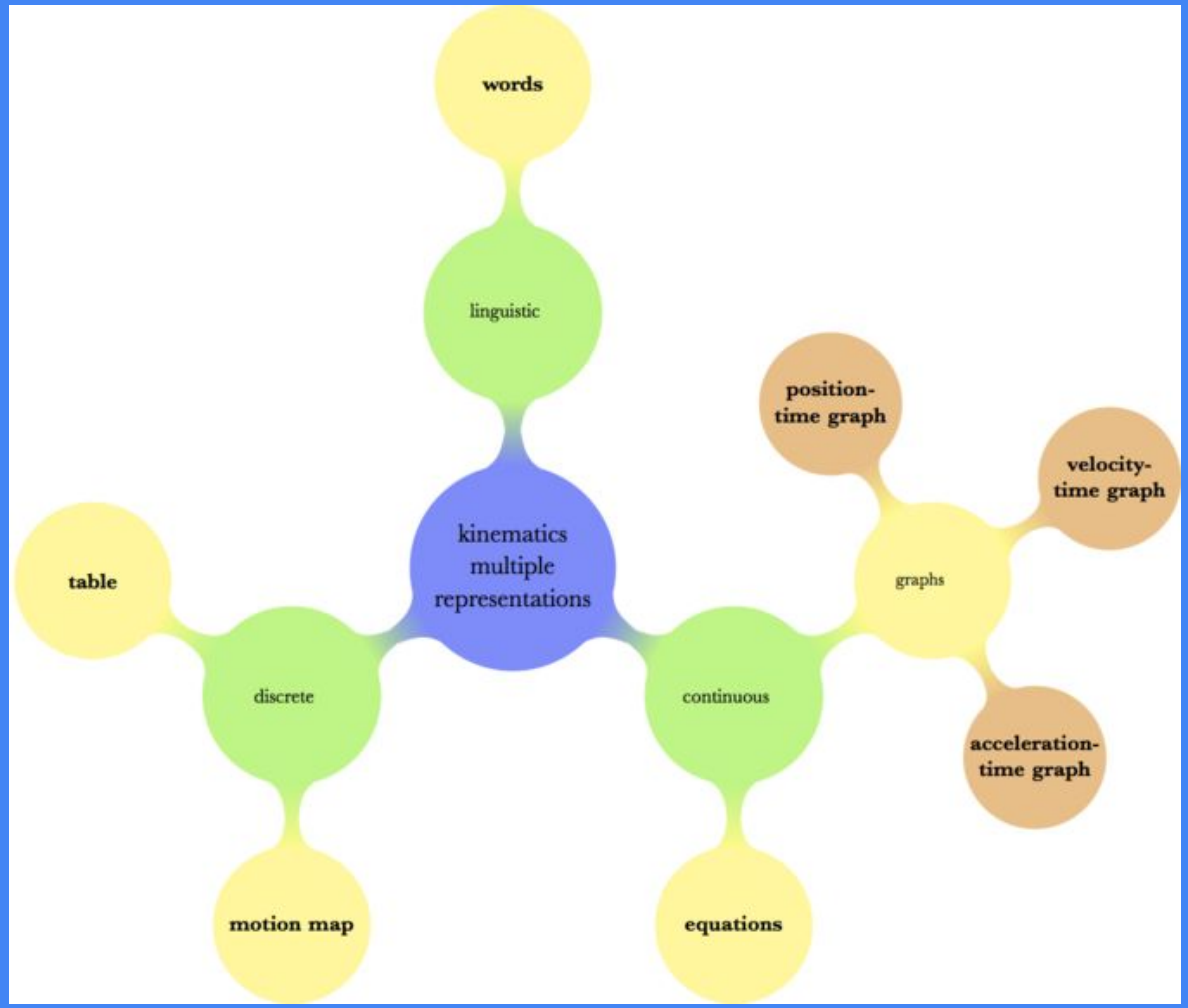
Physics Education Laboratory
Lecture 06
PCK for Kinematics

Francesco Longo - 21/10/20

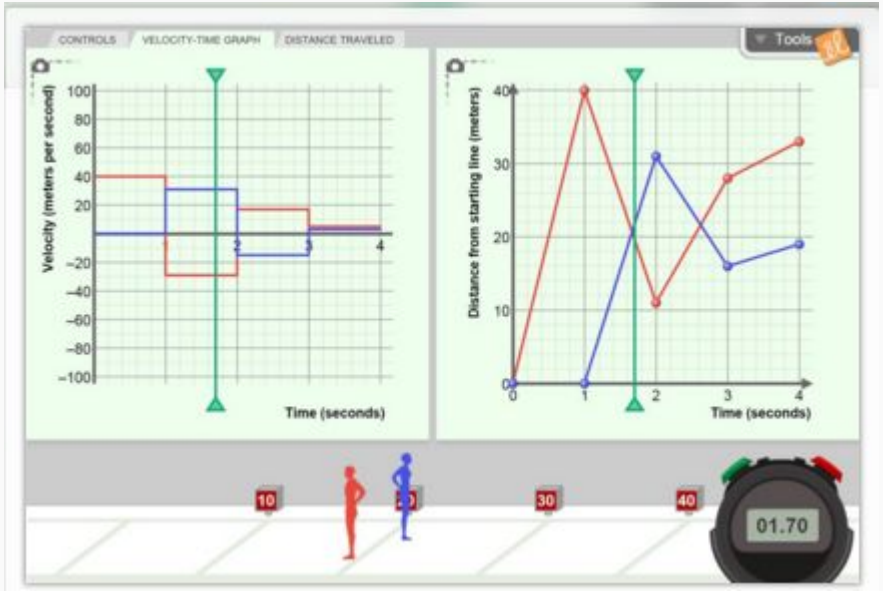

words
linguistic
kinematics
multiple
representations
table
discrete
motion map
continuous
equations
graphs
position-
time graph
velocity-
time graph
acceleration-
time graph

Kinematics with Multiple Representations

Opfermann M., Schmeck A., Fischer H.E. (2017) Multiple Representations in Physics and Science Education – Why Should We Use Them?. In: Treagust D., Duit R., Fischer H. (eds) **Multiple Representations in Physics Education. Models and Modeling in Science Education**, vol 10. Springer, Cham. https://doi.org/10.1007/978-3-319-58914-5_1

Distance -Time, Velocity-Time Graphs Metric

Create a graph of a runner's position versus time and watch the runner run a 40-meter dash based on the graph you made. Notice the connection between the slope of the line and the velocity of the runner. Add a second runner (a second graph) and connect real-world meaning to the intersection of two graphs. Also experiment with a graph of velocity versus time for the runners, and also distance traveled versus time.



https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=626

Students' Exploration Sheet

Analyze the sheet

Observe the use of Multiple Representations

Recognize the PCK features and the Math/Phys interplay patterns

Add one or more exercises to improve the Multiple Representations usage of this sheet

What's missing?

Student Exploration: Distance-Time and Velocity-Time Graphs

[NOTE TO TEACHERS AND STUDENTS: This lesson was designed as a follow-up to the Distance-Time Graphs Gizmo. We recommend you complete that activity before this one.]

Vocabulary: displacement, distance traveled, slope, speed, velocity

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
Dora runs one lap around the track, finishing where she started. Clark runs a 100-meter dash along the straight side of the track.

1. Which runner traveled a greater distance? _____

2. Which runner had a greater change in position, start to finish?

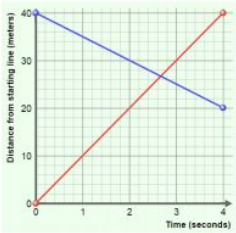
_____

Gizmo Warm-up
The *Distance-Time Graphs* Gizmo shows a dynamic graph of the position of a runner over time. The *Distance-Time and Velocity-Time Graphs* Gizmo includes that same graph and adds two new ones: a velocity vs. time graph and a distance traveled vs. time graph.

The graph shown below (and in the Gizmo) shows a runner's position (or distance from the starting line) over time. This is most commonly called a *position-time graph*.

Check that the **Number of Points** is 2. Turn on **Show graph** and **Show animation** for both **Runner 1** and **Runner 2**.

1. Drag the points to create the graph shown to the right.
   - **Runner 1**'s line (the red one) should have endpoints at (0, 0) and (4, 40).
   - **Runner 2**'s line (the blue one) should have endpoints at (0, 40) and (4, 20).



https://docs.google.com/document/d/1j4aRhzRD-f8p0X8tQrwTbU1Fk_-XG2z1eRbJ_dtkWUI/edit?usp=sharing

Parabolic motion

https://docs.google.com/document/d/1LlnUZRGfngJUhTTJEsIZuhMYNZ3o6Y72Y_ddkC0JxfA/edit