Lesson Title	2D Kinematics w/ String Racers
Length of Lesson	1 Day
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Subject	Physics
Grade Level	11-12 (Physics)
State Standards	Physics: 1a, g; 6b
DOK Level	DOK 4
DOK Application	Apply Concepts, Analyze
National Standards	9-12: B (physical); E (technology)
Graduate Research Element	

Student Learning Goal:
Physics: 1. Apply inquiry-based and problem-solving processes and skills to scientific investigations: (a) Use current technologies such as CD-ROM, DVD, Internet, and on-line data search to explore current research related to a specific topic; (g) Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.)

National Science Education Standards of Content 9-12
A (Inquiry): identify questions and concepts that guide scientific investigations.
B (Physical): objects change their motion only when net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects.
E (Science and Technology): abilities of technological design; understanding about science and technology

Materials Needed (supplies, hand-outs, resources):
Each group will need: 1 String Racer with string(marked with a marker every 1 meter) and 1 stop watch, and students will need access to a computer with a spreadsheet program with graphing capabilities (ex. Microsoft Excel).

Lesson Performance Task/Assessment:
Students will produce a lab report that will detail the objective of the lab, the methods used, their results, and conclusions.

Lesson Relevance to Performance Task and Students:
These concepts apply to nearly everything that moves in our world from cars, and other vehicles to a baseball or a bowling ball.

Anticipatory Set/Capture Interest:
From experience having the string racers already suspended from the walls across the class room was enough to get students excited. The teacher could ask the students to predict how long it will it take a racer reach the end of the line. Then, the teacher could release the string racer and time the run for the students.

Guided Practice:
Students in groups of four will be assigned to one string racer. Each group should have a leader, and each member have a job. The jobs are: releasing the racer, timing the racer, stopping the racer (in order to prevent damage to it from hitting whatever it may be tied to), and recording the time. Student will then use the 1 meter marks on the string to measure the time it takes the racer to travel 1, 2, 3, 4, &5 meters. The times for each distance should be measured multiple times and then averaged.

Independent Practice:
Students will plot and curve fit their data in a spreadsheet, and discuss their finding in a lab report.

Remediation and/or Enrichment:
Remediation: individual IEP; partner help throughout lesson; shorten parts of assignment; focus upon smaller elements of the process

Enrichment/Extension:

Using Vernier photo gates setup along the racer's path, students will use the computer for multiple point data acquisition. A discussion should be held on how every electronic measurement device only truly measures voltage.

Check(s) for Understanding:

Ask students to demonstrate potential versus kinetic energy with the string racers.
Discuss the motion equations and how they relate to the curve fits of the students' data.
"When the string racer is at the top of the line, is this a demonstration of potential or kinetic energy, why?"
"What causes your data to take the shape of a curve?"

Closure:

Discuss the motion equations and how they relate to the curve fits of the students' data.

Possible Alternate Subject Integrations:

*Math – can manipulate mathematical expressions to isolate needed variables

*Science – measurements are used constantly in all science labs

Teacher Notes:

Stretch the string out tight before marking it every meter. Most string will stretch enough to significantly damage the accuracy of the marks.