

1. Jeffrey Hsi
2. Valley Stream South H.S.
3. 11th – 12th grades
4. Regents Physics / AP Physics

5. CCLS Standards Addressed

ELA/Literacy -

RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Mathematics -

MP.2	Reason abstractly and quantitatively.
MP.4	Model with mathematics.
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSA.SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
HSA.SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
HSA.CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
HSA.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HSA.CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSF-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
HSS-IS.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).

6. Vernier Video Physics: \$4.99 in iTunes Store

<http://www.vernier.com/products/software/video-physics/>

<https://itunes.apple.com/us/app/vernier-video-physics/id389784247?mt=8>

7. Vernier Video Physics allows for the precise measurement and graphing of motion using the iPhone/iPad camera for video analysis. Students are able to videotape and track the motion of an object frame by frame. And by marking its position in each frame, students are then able to generate position-time and velocity-time graphs for both the x and y axis. All data can be saved as a *.csv file for easy export into a spreadsheet program. However, the data can also be directly incorporated into the iPad app, "Vernier Graphical Analysis" or with computers running Vernier Logger Pro software. All videos and measured data can also easily be exported and shared to your Camera Roll, Google Drive, or Dropbox.
8. Vernier Video Physics is a much cheaper and more versatile alternative to using motion detectors to measure the changing position of moving objects. Hand-held motion detectors generally are only able to measure motion on 1 axis, basically as an object moves away or toward it. However, this app

is able to track both 1-D and 2-D motion. This is especially useful when teaching Projectile Motion in a Physics classroom. By analyzing the motion of thrown objects, students are able to generate their own models of how motion works on each axis. This would be a student-driven experiment/lesson that links their prior knowledge of kinematics to the next unit of projectile motion. Through classroom discussion, students can also tie in the concepts of balanced vs unbalanced forces as well as more advanced topics, such as air resistance.

Furthermore, the data obtained from motion analysis can also be applied to other areas of mechanics as well. From conservation of energy to conservation of momentum, students will be able to individually derive the concepts from the multiple sources of information provided. Especially useful is the Vernier Logger Pro software because it is able to take the data and plug it directly into specific formulas so that certain trends can be more easily seen during the motion.