1. Jeffrey Hsi
2. Valley Stream South H.S.
3. 11^{th} – 12^{th} 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 in 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 Graphical Analysis: $4.99 in iTunes Store
   http://www.vernier.com/products/software/ga-ipad/
   https://itunes.apple.com/us/app/vernier-graphical-analysis/id522996341?mt=8

7. Vernier sells a variety of sensors and probes that allow for the collection of precise data within the science classroom, primarily physics and chemistry. Data can be collected with their handheld device, the Labquest 2, and then be shared over a wireless connection to other Internet connected devices, including an iPad. The iPad app, Vernier Graphical Analysis, provides the ability for students to independently analyze and manipulate the collected data. The students can use Graphical Analysis to create graphs between any of the measured variables, zoom in, make graph selections, create annotations and captions. Graphical Analysis also is provides statistical analysis tools, the most useful being linear/curve fits of specified portions of the data. After, students can export their data and/or graphs to create a lab report, either directly to Cameral Roll or Mail, or by exporting the data as a .csv file.

8. For use in the classroom, I would normally set up a physics lab that incorporates Vernier sensors or probes. For example, if I wanted to differentiate between static and kinetic friction, I would give

each lab setup a force sensor along with a stack of books to drag along. After the group collects the data together, each student can individually analyze the data using the Graphical Analysis app and then export that data into their own written/typed lab report. Or if it's too expensive to have a large number of probes to promote groupwork, the teacher can always conduct the experiment as a demonstration in front of the class, followed up by individual analysis by the students.

When looking at the data, the students are expected to be able to determine the relationship between the variables measured, and to generate the curve of best fit. Using physics modeling practices, I then have the students linearize their graph data to try to derive the actual physics formulas themselves. Graphical Analysis handles a lot of the legwork so that it's easy to crunch through numbers and arrive at conclusions together.