Collaborative Lesson Plan Summary
Programming and Web Development/Physics/Automotive
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Overview

The purpose of this lesson was to expose students to academic content, in this case Physics, they have not yet been introduced to. The activity requires them to utilize their Programming and Web Development (PWD) skills in order to develop tools that could then be used by students in the academic course, as part of their lab experience.

Prior to beginning the project, I met me physics teacher Eric Marshall and discussed the possibility of integrating content from one of his physics labs into a Programming and Web Development assignment. My desire was to have it be an assignment that was extremely calculation intensive so that the value of having a computer carry out the calculations would be immediately apparent.

Eric suggested an integrated lesson that he had already completed with Bruce Flood of Automotive. Within that project, students were asked to complete a large number of calculations in order to determine the speed of a vehicle based upon the gear ratio of the transmission (multiple calculation based upon which gear the vehicle was in), differential, tire size, and RPM of the motor. Due to the large number of calculations, physics students were only expected to complete a representative sampling of the possible combinations that could result in a given vehicle.

In the Programming and Web implementation of the project, students were presented with an basic introduction to the concept behind the calculations and the underlying mathematical calculations that were necessary to determine the speed of the vehicle. Students were then asked to design and develop a website that utilized javascript in order to calculate the speed of the vehicle for each gear ratio at a given RPM, as entered by the user.

Several fields within the HTML form were pre-populated with actual values found on car and tire manufacturer websites. Pages produced by PWD students were then made available for use by physics students so that they could check the values that they calculated by hand.

As an added benefit, Programming and Web students were able to visit the Automotive area and observe a lecture/demonstration on manual and automatic transmissions by Bruce Flood of Automotive. The ability to access learning experiences like the automotive demonstration truly highlight the advantage of teaching and learning in a CTE environment like Minuteman High School.

Standards

Concepts covered within the lesson touch upon both academic and CTE standards. These include:

Next Generation Science Standards

HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2.	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

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Information Technology Services Cluster
Programming and Web Development
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Embedded Academics

3.B.02c	7.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.
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3.B.04c	8.N.1	Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.
3.B.05c	7.P.4	Solve linear equations using tables, graphs, models, and algebraic methods.
3.B.06c	7.P.6	Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.

2.N Explain fundamental programming theory.

2.N.06	Describe the fundamental data types and their operations (including arrays).
2.N.07	Design program logic using graphical techniques (flow charts).
2.N.08	Design program logic using pseudocode techniques.
2.N.09	Identify the use of program design tools.
2.N.10	Explain structured/modular programming.

2.P Develop programs.

2.P.01	Develop programs using desired language.
2.P.02	Develop programs that use arithmetic operations.
2.P.03	Develop programs that use relational operators.
2.P.04	Explain and apply the use of logical operators.
2.P.05	Explain and apply compound conditions.
2.P.06	Explain and apply control breaks.
2.P.07	Explain and apply methods of calculating subtotals and final totals.

Follow Up

I plan to continue, and perhaps expand this activity next year. In addition, I will likely examine the framework connections to the updated, "draft" of the Programming and Web Development Frameworks. I have had discussions with Eric Marshall regarding the physics content and he has provided me with some of the resources that he uses when introducing the material in his class.