Best Practices II of Technology Integration

Title: Thinking Like an Engineer

Submitted by:

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Subject Areas: Mathematics and Physics

Intended Grade Level(s): 9 - 12

Description:

The main purpose of the unit is for students to experience different ways of learning Physics and Mathematics in real world applications. If students construct their own knowledge then possibly they will remember and understand this knowledge. The major goal of this unit is to develop thinkers, problem solvers, and team workers through the use of physics and mathematics concepts. The kinds of technology used in this unit include, Lego Dacta kits, calculator-based laboratories (CBL), graphing calculators, and computers with a multi-media program like ***power point***.

Narrative:

A Chinese Proverb is in the front of all AIMS books:

I Hear, and I Forget
I See, and I Remember
I Do, and I Understand

The premise is that if students are engaged, and actively participating in their learning that they will remember. If students remember then they can understand and apply this knowledge to other real life experiences. Students may even think about a career in the field of engineering. This unit opens the doors for all students to learn.

The standards of authentic instruction are met in this unit. The main approach will be through team learning, and cooperative learning skills (substantitive conversation and higher order thinking). The unit presents real life problems (connections to the world beyond the classroom) which students will solve in small teams. Experiencing the problem solving process through team learning, students will begin to distinguish, and comprehend the relationship between mathematics, physics, and technology (deep knowledge and higher order thinking).

The teachers (L. Webster and K. Reinhard) involved in this integrated unit are *modeling* team learning, and cooperative learning skills. The planning and implementation of this unit will use those same team skills. We also feel that it is very important for students to see and understand the relationship between physics and mathematics, and that there is real life application. The assessment part of this unit will include journals, peer evaluation, and an interview where the team will have to present their machine to a panel of people with the use of technology.

The physics class and the proficiency mathematics class, which share the same time period, will work together by the older students sharing the physics knowledge and the mathematics classes sharing their knowledge of team work and mathematics. Students from both classes will be learning/working together.

Technology improves both student learning and understanding of mathematics and physics concepts. The Lego Dacta kits provide a hands-on model of simple machine concepts and logical reasoning/problem solving in mathematics. The CBL gathers physical data and the graphing calculators provide a mathematical representation of the relationships found in the data. Assessment of students' understanding is a machine and a team presentation of the machine. The *power point* program gives the means to use technology in a sequential and creative manner.

Thinking Like an Engineer motivates students to be better learners. We observed students having substantive conversations about how to solve problems or accomplish goals. Students were enthusiastic about learning and understanding physics/mathematics concepts. In the beginning of this unit we observed students being frustrated by the concepts and the tasks expected of them. Through the teaching methods presented, students became better problems solvers, acquired team skills and persevered through difficult assignments. The technology was a tool to assist all students to learn. The team work skills were revealed when different students (not only physics students) were able to contribute their knowledge of technology in the use of the *power point* program. Students' presentations and machines were proof of the success of the teaching of the unit as well as the understanding and learning of the unit.

Curriculum Benchmarks:

MI.SCI.IV.3.HS.2 Describe that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. (Key concepts: Action force, reaction force. Real-world contexts: Walking, swimming, jumping, rocket motion.)

MI.SCI.IV.3.HS.3 Analyze the operation of machines in terms of force and motion. (Key concepts: Force, motion, and changes of motion— speeding up, slowing down, turning, push, pull, friction, gravity, attraction, repulsion, balanced, unbalanced. Real-world contexts: Machines, such as bicycles, automobiles, electrical motors, generators.)

MI.MAT.V.2.HS.2 Represent algebraic concepts and relationships with matrices, spreadsheets, diagrams, graphs, tables, physical models, vectors, equations and inequalities; and translate among the various representations.

Total amount of time for unit:

Nine weeks. Lesson plans are based on a Block Schedule, where each lesson is 83 minutes.

Materials/Hardware/Software:

Please refer to detailed daily lesson plan file

Teacher preparation:

Please refer to detailed daily lesson plan file

Prerequisite Students Skills:

Basic numeration skills (9th grade level), team work skills (listener, communicator, contributor, and is respectful of other team members), technology skills (able to use a graphing calculator, computer keyboard skills, the use of *power point)*, and physical science concepts (9th grade level).

Student Activities/Procedures:

Please refer to detailed daily lesson plan file

Assessment/Evaluation:

Please refer to detailed daily lesson plan file

Follow-up Activities:

For extensions and follow-up activities, refer to the Aims Book which incorporates extensions of specific activities used in the unit.

View or Print the Detailed Lesson