Form: "PACT - Science - 2. Planning Commentary Form v. 2009"

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Write a commentary that addresses the following prompts.

(REQUIRED) 1.

What is the central focus of the learning segment? Apart from being present in the school curriculum, student academic content standards, or ELD standards, why is the content of the learning segment important for your particular students to learn? (TPE 1)

This lesson focuses on quantifying energy and solving energy transfer problems. It teaches students how to calculate kinetic energy, gravitational energy, elastic potential energy, and work. Since energy is a conserved quantity, it can be transferred but not created or destroyed. This concept equips students with a new powerful strategy to solve problems that they were unable to solve with the basic kinematic equations. Energy is important for my particular students to understand because it is one of the most fundamental concepts in physics and it has a myriad of applications in all branches of science. In addition, it has a variety of practical applications to student's lives.

However, the scientific reasoning, logic, academic language, and inquiry skills taught in this lesson are perhaps even more important the content for students to acquire. These skills are transferable and highly beneficial.

(REQUIRED) 2.

Briefly describe the theoretical framework and/or research that inform your instructional design for developing your students' knowledge and abilities in both science and academic language during the learning segment.

The instructional design for this lesson was strongly based on the Modeling Theory of Physics, which has been developed by Dr. David Hestenes and his colleges at Arizona State University (http://modeling.la.asu.edu/index.html). The key principle behind modeling is to engage students collaboratively in making models to describe, explain, predict, design and control physical phenomena. The modeling approach for teaching physics is radically different than the traditional approach. Instead of being the "sage on the stage" the teacher takes on the roll of a learning facilitator.

The modeling approach is essentially a practical application of a variety of researched based theories including the following: constructivism (Seymour Papert), problem based learning, discovery based learning (Jerome Bruner, Seymour Papert, Jean Piaget), inquiry based instruction, active learning (Charles Bonwell and James Eison), cooperative learning, and social learning theory (Albert Bandura).

(REQUIRED) 3.

How do key learning tasks in your plans build on each other to support student learning of science concepts, inquiry skills, and the development of related academic language? How will students use the science concepts and inquiry skills to make sense of one or more real world phenomena? Describe specific strategies that you will use to build student learning across the learning segment. Reference the instructional materials you have included, as needed. (TPEs 1, 4, 9)

All the key learning tasks in this lesson segment build upon prior student knowledge. In fact, the entire

curriculum of the class spirals and builds upon itself. I make a concerted effort to show how physics concepts are related. For example, when I introduced joules as a unit of energy, I showed how it is equivalent to a newton times a meter. This makes sense because work = force * distance and work is measured in joules, force in newtons, and distance in meters.

The procedure for the lab planned on Day 1 of this lesson was developed in a collaborative discussion that was held the previous week. This discussion was based on the basic principles of conservation of energy that were taught the previous week and relied heavily on the inquiry skills that students have been acquiring throughout the course.

The activity on Day 3 of this lesson similarly relied on the accumulated knowledge and inquiry skills. With the property scaffolding, student were in the zone of proximal development with this activity and able to complete the goal. However, if students had not been exposed to the previous material, it is doubtful that they would have been able to succeed.

Homework and quiz questions also require students to relate current concepts to prior knowledge. For example, on the quiz, students had to combine their knowledge of uniform circular motion, gravitational potential energy, and kinetic energy to solve a problem where an object is sliding around a loop (Question 13).

I use a variety of real world examples in class. Homework problem number #4 from worksheet #2 is one example. In this problem, students are asked, "Which takes more work, accelerating a car from 10 to 20 m/s or from 20 to 30 m/s?" This lead to a good discussion of why accelerating to high speeds between red lights wastes gas.

(REQUIRED) 4.

4. Given the description of students that you provided in Task 1.Context for Learning, how do your choices of instructional strategies, materials, technology, and the sequence of learning tasks reflect your students' backgrounds, interests, and needs? Be specific about how your knowledge of your students informed the lesson plans, such as the choice of text or materials used in lessons, how groups were formed or structured, using student learning or experiences (in or out of school) as a resource, or structuring new or deeper learning to take advantage of specific student strengths. (TPEs 4,6,7,8,9)

The classroom is a relatively homogenous group of students with regard to academic, social, and language development compared to a typical classroom. All the students have completed Algebra 2AB and are in Honors Trigonometry and have excellent algebra skills. All of the students in the class are in the honors program and are used to having high expectations set for them.

The modeling approach suits the background, needs, and interests of this student population exceedingly well. This group of students has an interest in problem solving and finds challenges motivating. This group of students can think abstractly and has the inquiry skills necessary to make this approach work. In addition, every student in the class is comfortable speaking in front of the class and will gladly participate in class discussions. This is essential to make the whiteboard activities run smoothly.

Many students in the class are competitive academically. I attempted to harness this competitiveness by trying to turn the activity on Day 3 into a game.

(REQUIRED) 5.

For this learning segment, identify students' possible common sense understandings or misconceptions that contrast with accepted scientific understandings. How will you detect and attempt to change these common sense understandings or misconceptions?

Students have the misconception that when energy is "used" that it disappears. I emphasize that energy is not created or destroyed, but rather transferred. I will address this misconception by avoiding the word

"used" and always ask for clarification when students used this word in class.

(REQUIRED) 6.

Consider the language demands of the oral and written tasks in which you plan to have students engage as well as the various levels of English language proficiency related to classroom tasks as described in the Context Commentary. (TPE 7)

a. Identify words and phrases (if appropriate) that you will emphasize in this learning segment. Why are these important for students to understand and use in completing classroom tasks in the learning segment? Which students?

b. What oral and/or written academic language (organizational, stylistic, and/or grammatical features) will you teach and/or reinforce?

c. Explain how specific features of the learning and assessment tasks in your plan, including your own use of language, support students in learning to understand and use these words, phrases (if appropriate), and academic language. How does this build on what your students are currently able to do and increase their abilities to follow and/or use different types of text and oral formats?

a. Identify words and phrases (if appropriate) that you will emphasize in this learning segment. Why are these important for students to understand and use in completing classroom tasks in the learning segment? Which students?

I will emphasize the following words in this learning segment for all students: interpret, force, newton, joule, equation, plot, graph, calculate, predict, model, initial, final, variables, criteria, report, analyze, state, gravity, units, concept, evaluate, measure, quantify, state, diagram, investigate, interpret, intercept, trend, coefficient, error, restate, describe, domain, range, constant, displacement, and height.

b. What oral and/or written academic language (organizational, stylistic, and/or grammatical features) will you teach and/or reinforce?

I will reinforce the use of units with quantities in both oral and written language.

I will teach the organization of a lab report.

I will reinforce academic language by modeling it orally throughout this lesson segment.

c. Explain how specific features of the learning and assessment tasks in your plan, including your own use of language, support students in learning to understand and use these words, phrases (if appropriate), and academic language. How does this build on what your students are currently able to do and increase their abilities to follow and/or use different types of text and oral formats?

My own use of language serves as a model for students to follow. I am intentionally very careful with the way I phrase things in the class room, and I reward students with points who catch me for making errors like spelling, punctuation, units, etc. Once students have been introduced to new academic language by the teacher and have seen in model, students are then able to begin to practice it.

White boarding activities provide an excellent platform to for the teacher to assess student academic language. It also allows the teacher to give timely and effective feedback. This encouragement and additional modeling by both the teacher and their peers allows students to build upon what they already know and increase their abilities.

(REQUIRED) 7.

7. Explain how the collection of assessments from your plan allows you to evaluate your students' learning of specific student standards/objectives and provide feedback to students on their learning. (TPEs 2, 3)

Reading through the lab report will allow the teacher to assess if the following objectives have been met:

- Students will discover that the kinetic energy of an object is proportional to its velocity squared. Students will make this discovery after they linearizing the graph of the velocity versus kinetic energy of data collected in this lab. All students will be able to adequately explain this relationship in the lab report according to the criteria set out in the rubric.
- Students will discover that the velocity of an objected squared is proportional to the inverse of its mass if kinetic energy is kept constant. Students will make this discovery after they linearizing the graph of the velocity versus mass of data collected in this lab. All students will be able to adequately explain this relationship in the lab report according to the criteria set out in the rubric.
- Students will discover that the kinetic energy of an object is proportional to mass. Students will make this discovery after they combine the two proportionalities listed above. All students will be able to adequately explain this relationship in the lab report according to the criteria set out in the rubric.
- Students will combine these to proportionalities to produce a quantitative model for kinetic energy of the form kinetic energy = kmv^2, where k is a constant. Students will calculate the value of this constant with less than a 15% error compared to the accepted value of 0.5.
- Students will be able to correctly calculate the kinetic energy of an object given its mass and velocity using the equation kinetic energy = 0.5 mv^2 with 100% accuracy on homework assignments and the unit quiz.
- Students will be able to solve problems involving the conversion of elastic potential energy to kinetic energy by using the energy flow diagram approach with 100% accuracy on the lab report, homework, and unit quiz.
- Students will be able to write a lab report with in one week of completing this activity that scores at least 18 out of 25 based of a rubric. This lab report will show their understanding of error analysis, proper equipment usage, interpretation of graphs, logical explanations, the scientific method, scientific terms, creating and using models, analyzing situations, problem solving, and statistical variability.

Grading the quiz will similarly show the teacher how well the following standards have been meet:

- **Standard a.:** Students know how to calculate kinetic energy by using the formula E =(1/2)mv^2 .
- **Standard b:** Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).
- **Standard c:** Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.
- **Standard e:** Students know momentum is a separately conserved quantity different from energy.
- **Standard f:** Students know an unbalanced force on an object produces a change in its momentum.
- **Standard h:** Students know how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.

(REQUIRED) 8.

Describe any teaching strategies you have planned for your students who have identified educational needs (e.g., English learners*, GATE students, students with IEPs). Explain how these features of your learning and assessment tasks will provide students access to the curriculum and allow them to demonstrate their learning. (TPEs 9. 12)

*If you do not have any English Learners, select a student who is challenged by academic English. Examples may include students who speak varieties of English or special needs learners with receptive or expressive language difficulties.

No students in the class have identified educational needs. Some students in the class are challenged by academic language, but they still have complete access to the curriculum. The strategies that I would develop to address this would benefit the entire class as well. The strategies discussed in question 6c would be applicable in this case.