Student Teacher Evaluation Plan
STEP 3

The content that will be taught during my student teaching experience is determined by a pre-planned curriculum. The subjects that I must teach during my ten weeks of student teaching are as follows: Magnetism, and how it relates to electricity; Newton's Laws of motion; Conservation of energy and of momentum; and Kepler's Laws of Planetary motion (this is covered in May, so it is very likely that I will not get to this topic).

I. PRECONCEPTIONS

Magnetism

- North and south magnetic poles are the same as positive and negative charges.
- Magnetic field lines start at one pole and end at the other.
- Poles can be isolated.
- Flux is the same as field lines.
- Flux is actually the flow of the magnetic field.
- Magnetic fields are the same as electric fields.
- Charges at rest can experience magnetic forces.
- Magnetic fields from magnets are not caused by moving charges.
- Magnetic fields are not 3-dimensional.
- Magnetic field lines hold you on the Earth.
- Charges, when released, will move toward the poles of a magnet.
- Electricity and magnetism are two different forces.
- All forces have to be contact forces.
- None of the fundamental forces have been proven to exist.

Newton's Laws of Motion

- Action-reaction forces act on the same body.
- There is no connection between Newton's Laws and kinematics.
- The product of mass and acceleration, ma, is a force.
- Fiction can't act in the direction of motion.
- The normal force on an object is equal to the weight of the object by the 3rd law.
- The normal force on an object always equals the weight of the object.
- Equilibrium means that all the forces on an object are equal.
- Equilibrium is a consequence of the 3rd law.
- Only animate things (people, animals) exert forces; passive ones (tables, floors) do not exert forces.
- Once an object is moving, heavier objects push more than lighter ones.
- Newton's 3rd law can be overcome by motion (such as by a jerking motion).
- A force applied by, says a hand, still acts on an object after the object leaves the hand.

Conservation of Energy

- Energy gets used up or runs out.
- Something not moving can't have any energy.
- A force acting on an object does work even if the object does not move.
- Energy is destroyed in transformations from one type to another.
- Energy can be recycled.
- Gravitational potential energy is the only type of potential energy.
- When an object is released to fall, the gravitational potential energy immediately becomes all kinetic energy.
- Energy is not related to Newton's laws.
- Energy is a force.

Conservation of Momentum

- Momentum is not a vector.
- Conservation of momentum applies only to collisions.
- Momentum is the same as force.
- Moving masses in the absence of gravity do not have momentum.
- The center of mass of an object must be inside the object.
- Center of mass is always the same as the center of gravity.
- Momentum is not conserved in collisions with "immovable" objects
- Momentum and kinetic energy are the same.

Kepler's Laws

- Planetary orbits are circles.
- The speed of a planet in orbit never changes.
- An object must be at both foci of an elliptical orbit.
- All the planets move in their orbits with the same speed.
- No work is done on orbiting planets by the sun.
- The orbits of the planets lie precisely in the same plane.
- All the planets revolve about the sun with the same period.
- Revolution is the same as rotation.

C3P List of Physics Preconceptions. University of Dallas.
http://phy.ilstu.edu/pte/310content/constructivism/Udallas_preconceptions.pdf

As an example of how I would elicit, identify, confront, and resolve such preconceptions, and that they are highly resilient to change, I will use the example that *all forces must be contact forces*. This preconception will elicit itself during classroom discussions regarding magnetic fields in that students might become confused and ask questions regarding if a magnetic field causes a force on another object. Once a preconception has been elicited, we, as a class will identify it by asking the student questions as to why they think a force

is applied only when object makes contact with another object. I believe that this preconception can be resolved by first discussing what and why the student believes this to be so and then by asking them how a nail is drawn toward a magnet. This will be followed by having the students actually interact with raw materials and feeling the forces that magnetic fields produce.

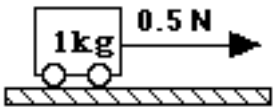
II. OBJECTIVES, ACTIVITIES, AND ASSESSMENTS

Assignment #1: The Major Concepts, Principles, Theories and Laws of Science
Objectives: Students will:

- Students will, given an irregularly shaped, 2-dimensional object, determine its center of mass.
- Students will develop a theoretical explanation (based on Newton's second law) that explains why heavier objects do not accelerate at a rate different from that of lighter objects
- Students will work with dynamics carts and suitable spring scales to determine the principle relating force and acceleration.
- Students will quantify the above relationship (Newton's 2nd law) by conducting an experiment in which all extraneous variables are controlled.
- Students will resolve the traditional Newton's 3rd law paradox (horse and cart problem). The problem of the tug-of-war can be used to examine Newton's third law, and give some physical meaning to the idea of "equal and opposite" forces. Have two students with large spring scales pull on opposite ends of a rope. Tell the first student to pull "hard" (as shown by the first spring scale), and the second student to pull "not so hard" (as shown by the second spring scale). Regardless of how hard either student pulls, the scales will always read the same. This is what Newton's third law is all about. Pose the question, "If the students are both pulling with equal and opposite force (which is clear from the readings of the two spring scales), then how is it possible that one student can ever expect to win over the other in a tug-of-war competition?
- Students will create and conduct an experiment to determine what effect the mass of an object has on the sliding force of friction on a horizontal surface.
- Students will create and conduct an experiment to determine what effect the surface area of an object has on the sliding force of friction on a horizontal surface.

For assignment #1, a pretest-posttest will be used for the unit Newton's Laws of Motion which will be based on a concept inventory. A posttest has already been designed for this particular unit, and will undoubtedly be utilized in order to assess students at the end of the unit. There are fifteen questions involved with the "content exam" that has already been designed. Only half of the questions will be used for the pretest. The questions on the posttest exam will be parallel to those of the pretest; however, different verbiage as well as numbers will be used. In order to track student performance, I will conduct a "T test analysis" using Microsoft Excel. This way I will be able to compare individual student

performances directly as well as conduct a student test that requires matched pairs; and more importantly, conduct the Student's t test that requires matched pairs.
The objectives as well as the alignment to the Illinois State Standards for the posttest are clearly stated in the alignment table provided along with the posttest.



Name_____
Date _____ **Pd**____

Newton's Laws of Motion

For questions 1-6, consider the cart on a track below. A force is applied acting to the right. Assume that friction is *negligible*.

For each question, one or more features of the system has been changed. You are to indicate **what effect the change will have on the acceleration.**

Use the following answer key.

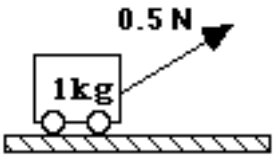
a. The acceleration will be greater.
b. The acceleration will be less.
c. The acceleration remains the same.
d. It's not possible to tell.

__1. The mass of the cart is increased to 2 kg.

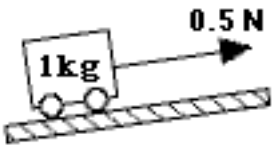
__ 2. The towing force is increased to 1.0 N.

__ 3. *Both* the mass of the cart and the towing force are doubled.

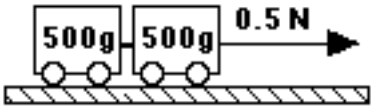
__ 4. The 0.5 N towing force is applied at an angle as shown at right.



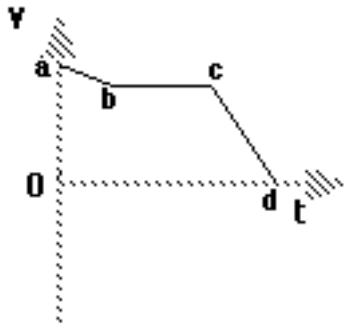
__ 5. The track is inclined as shown below.



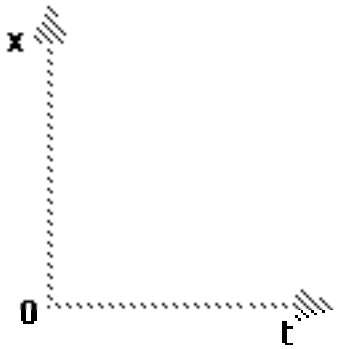
__ 6. The 0.5 N force is applied to two 500 g carts hooked together as shown below.

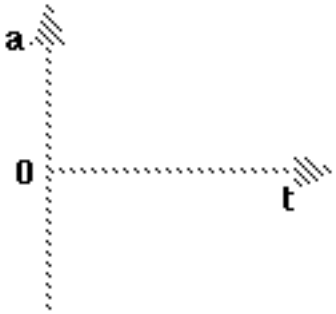


Below is the **velocity** vs. **time** graph for a train. Use the graph to answer questions 7 -10.



7. Draw the **position** vs. **time** and **acceleration** vs. **time** graphs corresponding to the velocity graph between points **c** and **d**.





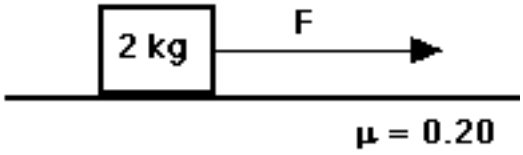
8. For the interval from **a** to **b** the train is:
   a. speeding up.
   b. slowing down.
   c. moving at constant speed.
   d. moving in the negative direction.

9. Is the net force on the train equal to zero at any time? Explain.

10. Where is the net force on the train the largest? Explain.

11. A 700. kg Yugo can go from rest to a speed of 45 m/s in 9.0s. What average net force acts on the car?

12. Consider the block on a surface below.
The coefficient of friction, μ, is 0.20.

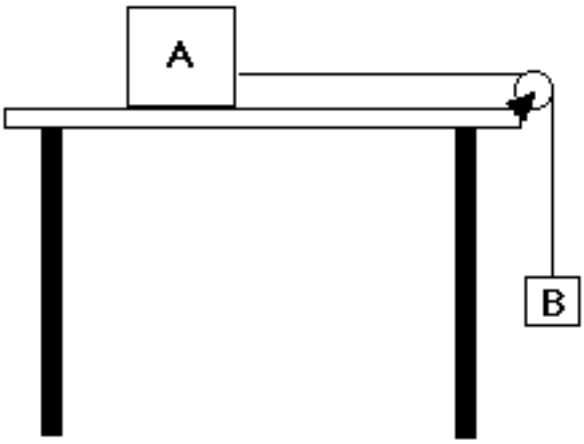


a. If a 10. N force is applied to the block, what is its acceleration?

b. How fast will the block be moving if the force is applied for 5.0s?

c. How far will the block have traveled during this 5.0s period?

13. The diagram at left depicts a frictionless apparatus similar to that used for your Newton's 2nd Law experiment. Block A has a mass of 25 kg and block B has a mass of 5.0 kg.

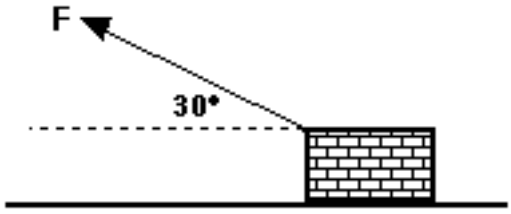


a. Draw force diagrams for block A and block B.

b. Determine the acceleration of the system.

c. What is the tension in the string?

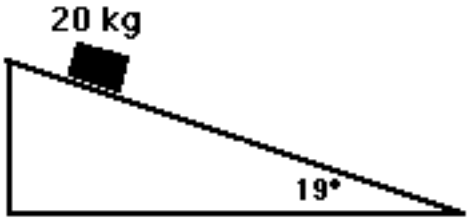
14. A 70.0 kg box is pulled across a *frictionless* surface by a 300. N force at an angle of 30.° to the horizontal.



a. What is the acceleration of the box in the x-direction?

b. What is the normal force on the box?

15. A 20.0 kg block is allowed to accelerate down a ramp with negligible friction.



a. Draw a force diagram for the block.

b. Determine the acceleration of the block. Show work.

c. Would the acceleration be different if the mass of the block were 10kg? Explain.

16. Two metal balls are the same size, but one weighs twice as much as the other. The balls are dropped from the roof of a single story building at the same instant. The time it takes the balls to reach the ground below will be

    a. About half as long for the heavier ball as for the lighter one.
    b. About half as long for the lighter ball as for the heavier one.
    c. About the same for both balls.
    d. Considerably less for the heavier ball, but not necessarily half as long.
    e. Considerably less for the lighter ball, but not necessarily half as long.

17. A large truck collides head on with a compact car. During the collision

    a. The truck exerts a greater amount of force on the car than the car exerts on the truck.
    b. The car exerts a greater amount of force on the truck than the truck exerts on the car.
    c. Neither the truck nor the car exert any force, the car simply gets smashed because it got in the way of the truck.
    d. The truck exerts a force on the car, but the car does not exert a force on the truck because the truck is bigger.

18. A girl throws a steel ball straight up into the air. Consider the motion of the ball only after it has left the girl's hand but before it touches the ground, and assume the forces exerted by the air are negligible. For these conditions, the force(s) acting on the ball is (are)

    a. A downward force of gravity along with a steadily decreasing upward force.
    b. A steadily decreasing upward force once it leaves the girl's hand until it reaches the highest point; on the way down, there is a steadily decreasing downward force of gravity as the ball gets closer to the Earth.
    c. An almost constant force of gravity along with an upward force that steadily decreases until the ball reaches the highest point; on the way down there is only an almost constant downward force of gravity.
    d. Only an almost constant force of gravity.
    e. None of the above. The ball falls back to the Earth because its natural tendency to rest on the surface of the Earth.

19. A woman exerts a constant horizontal force on a large box. As a result, the box moves across a horizontal floor at a constant speed v_0. The constant horizontal force applied by the woman:

    a. has the same magnitude as the weight of the box.
    b. is greater than the weight of the box.
    c. has the same magnitude as the total force which resists the motion of the box.
    d. is greater than the total force which resists the motion of the box.

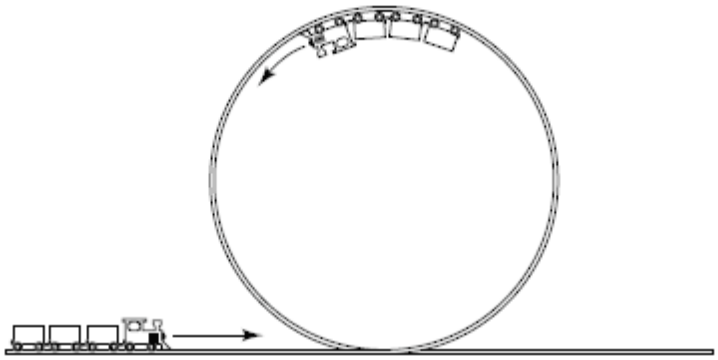
e. is greater than either the weight of the box or the total force which resists its motion.

20. If the woman in the previous problem stops applying a horizontal force to the box, then the box will:

a. immediately come to a stop.
b. continue moving at a constant speed for a while and then slow to a stop.
c. immediately start slowing to a stop.
d. continue at a constant speed.
e. increase its speed for a while and then start slowing to a stop.

21. What is the smallest force with which you can raise an object on Earth into the air?

22. A toy train travels around a loop-the-loop track, as shown below. (*a*) Is there a normal force exerted by the track on the train at the instant the train is at the top of the loop? (*b*) Why is it that riders feel weightless at the top of certain roller coasters?



Assignment #2: The Unifying Concepts of Science

Objectives:

Students will:

- Systematically create intelligible explanations for the order and organization inherent in natural systems (systems, order and organization).
- Create explanatory models based on empirical evidence, and use these models to predict and explain the behavior of natural systems (evidence, models and explanation).
- Demonstrate that predictable, cause-and-effect relationships underlie changes or maintain constant interactions in the natural world (evolution and equilibrium).
- Apply and adapt their talents and knowledge to find outcomes to real life problems.
- Study the relationships and interactions of form and function in natural objects and systems (form and function).
- Study the affects of an electric field by field mapping electric fields.
- Explain how electric fields diverge by referencing the field maps of E fields.

In order for the students to demonstrate an ability to comprehend the unifying concepts of science, the students will complete a Problem Based Learning (PBL) activity entitled: *When Lightning Strikes*.

Introduce this PBL before learning about electric fields. Allow students three or four weeks to work together. Students will form a hypothesis of the cause of the death. Work out with them at the beginning what they know, need to know; use the chart WE used for the Nuclear Power Plant PBL. Form three to four solid hypotheses and students will be assigned into groups to research the possibility of their hypothesis being the actual reason for the softball player's death.

Allow students to research the possible reasons, then come together as a group and reevaluate the possible hypotheses. Students will present their arguments to the class and why they believe their reason to be correct. Keep in mind that there may be more than one correct answer based on the evidence presented to the students. Students will be evaluated on their performance presentation as well as by their peer assessments. The rubric that was designed in Physics 311 for evaluating peers will be used.

Assessor: _____ Peer: _____

PBL Peer Participation Scoring Rubric

Role	Failing (0 pts)	Poor (1 pt)	Fair (2 pts)	Good (3 pts)	pts
Initiator	Peer is no leader and a poor follower; contributes few if any meaningful ideas to the discussion; no one follows ideas.	Peer shows a minimum of leadership skills; peer some times contributes a hopeful idea, but most are rejected; no critical contributions.	Peer is an active but not always effective leader; generally provides several useful ideas; serves as a devil's advocate.	Peer a real leader; initiates work and gets others to accomplish tasks; serves as a good devil's advocate to help develop the case.	
Information Seeker	Peer does not follow through on work assignments or if he or she does so; job far below minimum expectations.	Peer generally follows through on work assignments but the quality of the submissions suggests a lack of commitment.	Peer always follows through on assignments, but is sometimes unable to accurately summarize findings meaningfully.	Peer finds lots of useful resources, understands them, and summarizes them in a meaningful and useful way for the group.	
Consensus Builder	Peer makes comments that are positively divisive and lead to disruption of group efforts.	Peer is sometimes divisive, but can be brought around to seeing others' points; will acquiesce in the face of strong opposition.	Peer has difficult time seeing perspectives of others, but generally appreciates others' viewpoints.	Peer seeks to build a strong consensus among team members; constantly makes efforts to minimize individual differences.	
Compromiser	Peer is completely and illogically inflexible in his or her positions; completely wrong.	Peer is unable to take a meaningful stand on any issue suggestive of lack of understanding.	Peer takes stands, but argues on the basis of misinformation; yields to the group properly.	Peer argues his or her point eloquently but changes mind in light of suitable evidence.	
Housekeeper	Peer contributes to discussion, but is not at all concerned with documenting findings; lives for the moment only.	Peer somewhat helpful in that he or she reminds others to maintain or add to the record; contributes little or nothing to the actual process.	Peer generally helpful in making and recording conclusions and decisions; willing to maintain or add to the record if asked.	Peer is positively helpful in keeping track of conclusions and decisions; provides helpful suggestions for group procedures.	
Communicator	Peer is unable to communicate in an acceptable manner, and sometimes attacks people rather than ideas; disliked by other team members.	Peer is an ineffective communicator; talks about everything except for the subject at hand; tends to irritate other team members.	Peer is a good communicator, but has difficulties expressing points or stating position; generally well liked by others on team.	Peer is able to effectively and clearly communicate ideas on a regular basis; well liked by team members.	
Listener	Peer is unwilling to listen to others; completely entrenched in own position.	Peer waits while others speak but is not really listening; is intolerant of opposing views.	Peer is open minded, and is willing to listen to others and change mind as appropriate.	Peer practices active listening, and can both reflect and sympathize with views of others.	
Conflict Resolver	Peer only sees one point of view; blames others for various faults; conflict producer.	Peer listens to other points of view, but does little or nothing to help resolve conflicts.	Peer is sympathetic to all points of view and suggests constructive ways of resolving conflicts.	Peer identifies and articulates opponents' perspectives about various issues; conflict resolving ability clear.	
Contributor	Peer's presence is positively disruptive, leading to wasted time and frustration among team members; mostly or always absent from team meetings.	Peer frequently strays from topic at hand reducing the amount of work the group might have accomplished; present at most team meetings with 1 or 2 misses.	Peer on task most of the time but sometimes leads the group astray into irrelevant areas of discussion; present for all meetings, or absent with legitimate excuse.	Student is actively engaged in meaningful whole-group efforts and provides constant contributions; present for all meetings, or absent with legitimate excuse.	
Critical Thinker	Peer cannot make useful sense of the information group members find.	Peer contributes minor sub-points – information – for the construction of arguments.	Peer contributes one or two complete arguments for or against a viewpoint on a given issue.	Peer is able to build persuasive arguments from evidence, as well as analyze errors in the thinking of others.	
				Percentage of 30 possible points:	
Assessor comments:					

Assessor: _____ Presenter: _____

PBL Oral Presentation Scoring Rubric

Your expert essay should reflect the processes and procedures of critical thinking; your oral presentation should reflect critical thinking dispositions.

Disposition	Failing (0 pts)	Poor (1 pt)	Fair (2 pts)	Good (3 pts)	pts
Being well informed	Presenter clearly does not understand the issue, and the science and human values surrounding it.	Presenter's knowledge is basically correct, but errors are more numerous and substantial.	Presenter's knowledge appears to be accurate with only a few minor and no major errors of fact.	Presenter clearly has a thorough understanding of both the science and the arguments surrounding the issue.	
Staying focused	Presenter varied from subject matter to such an extent as to produce substantial distraction.	Presenter included substantial amount of non-pertinent information.	Presenter included a small amount of non-pertinent information, but most "on target."	Presenter included relevant and meaningful information only.	
Willing to evaluate alternatives	Presenter did not present opposing views; only own views enter in to presentation.	Presenter mentioned opposing viewpoints, but did not address them meaningfully.	Presenter addressed in a weak way the pros and cons of major alternative solutions.	Presenter clearly and forthrightly addressed pros and cons of major alternative solutions.	
Taking a supportable position	Presenter did not state position, or stance taken was strongly based on emotion and/or weak logic.	Presenter ambiguous or did not make a clear statement of his or her position on the issue; indecisive.	Presenter clearly indicated where s(he) stands on the issue, but make a weak argument in favor of that position.	Presenter clearly indicated where (s)he stands on the issue and make a substantial logical argument in support of it.	
Seeking precision	Presenter clearly has problems with the facts, errors in scientific information, includes pseudo-science; grossly misrepresents other's positions.	Presenter gave vague references to facts and the opposition or arguments of others; otherwise, made one or more major errors in fact about alternative positions.	Presenter did a reasonably good job accurately representing the facts and ideas of other; presentation contained a small number of minor errors or misrepresentations.	Presenter accurately represents the facts as well as the arguments of those with whom (s)he disagrees; made clear and concise statements leaving no uncertainty.	
Proceeding in a logical and orderly manner	Presentation is illogical, disorganized, confusing, and ultimately disinteresting.	Presenter gave a somewhat disorganized delivery, but the main points were still clear.	Presenter made a reasonably logical presentation, but migrations resulted in minor confusion.	Presenter methodically addresses topic from presentation of issue to solution of problem; well organized.	
Being sensitive to others' positions	Presenter clearly shows disdain for those with opposing views, and exhibits clear signs of prejudice and/or disrespect toward the opposition.	Presenter does not appear to even care to understand the positions of opposition; comes across as cold toward or ignores opposition.	Presenter clearly understands but does not sympathize with the viewpoints of opponents; comes across as detached from the opposition.	Presenter clearly understands and sympathizes with beliefs of others that are based on authentic science and rational values.	
				Percentage of 21 possible points:	

Assessor comments:

Alternative **Assignment #2: The Unifying Concepts of Science**
Objectives: Students will:

- Systematically create intelligible explanations for the order and organization inherent in natural systems (systems, order and organization).
- Create explanatory models based on empirical evidence, and use these models to predict and explain the behavior of natural systems (evidence, models and explanation).
- Demonstrate that predictable, cause-and-effect relationships underlie changes or maintain constant interactions in the natural world (evolution and equilibrium).
- Apply and adapt their talents and knowledge to find outcomes to real life problems.
- Using evidence, analyze and report to the *committee* who is to blame for the real life accident.
- Study the relationships and interactions of form and function in natural objects and systems (form and function).
- Use understanding of the principles of forces, motion, and energy to design a plan to reconstruct a car accident.
- Explain how frictional forces related to varying surfaces affect the motion of an object.
- Calculate the velocities of two vehicles before and after impact using physics principles, such as forces, motion, mechanical energy, and conservation of momentum.
- Evaluate real world data related to a car accident in order to make a judgment about the drivers' fault.
- Find and use appropriate learning resources to aid in reconstructing the accident.

For this activity, Students will participate in the PBL*, A Day in the Life of John Henry, A Traffic Cop***.** Written by Barbara Duch. 1993, Revised 1995. Print off the details about the accident for the students to view, and give students helpful web addresses that may be a form of assistance for them. Go to website for all the details!
➔ http://www.udel.edu/pbl/curric/acc12.html
All materials are printed off and ready (check Binder labeled STEP 3)
All materials are saved in folder "PBL"

Assignment #3: Technological Applications in Science
Objectives: Students will:

- Write a short essay on the affects an airbag has on the occupants during a collision
- Relate their findings to conservation of momentum and impulse
- Describe safety concerns with regards to airbags
- Describe advantages of airbags

After viewing the *Car Crash* video, you now have a better understanding of why cars are designed to crumple at the hood of the car when involved in a head-on collision. You are to write a short paragraph below describing what the advantages are of having an airbag deploy during an impact. Be sure to integrate impulse and conservation of momentum into your response.

Alternative
Assignment #3: Technological Applications in Science
Objectives: Students will:

- Be assigned to a particular group on a major panel that decides the fate of a huge theme park.
- Determine which natural and man-made hazards may exist,
- Evaluate how serious these risks are, either by themselves or in combination,
- If necessary or possible, propose plans which could reduce these risks to acceptable levels, and
- Provide a final recommendation regarding whether or not the park should be built.
- Present their findings in the form of a written essay

Students will participate in a PBL called SUPERLAND! They will be assigned the task of making the decision of whether or not this theme park should be built in the specified location of Southern Illinois. They will collaborate with one another in order to evaluate if the risk outweighs the reward. All materials can be obtained from the following website
➔ http://www2.imsa.edu/programs/pbln/problems/superland/

SuperLand!

How Safe Is It?

Introduction

A proposal has been made to build a new super-theme park in southern Illinois, to be called SuperLand!. A group of investors from the United States and Japan have joined together on this venture to design and build the largest theme park in the world. They have chosen southern Illinois because of its central location and proximity to such major metropolitan areas as Louisville, Memphis, St. Louis, Nashville, and Chicago. (A map of the midwest region may be downloaded by clicking **here**).

It is planned that SuperLand! be built on 1500 acres located just outside of Metropolis, Illinois. The land is situated near the Ohio River, and the amusement park will be accessable by a new proposed highway, monorail from the local airport (which will need to be enlarged), high speed rail from major cities, and by riverboat.

Economic Aspects And Benefits

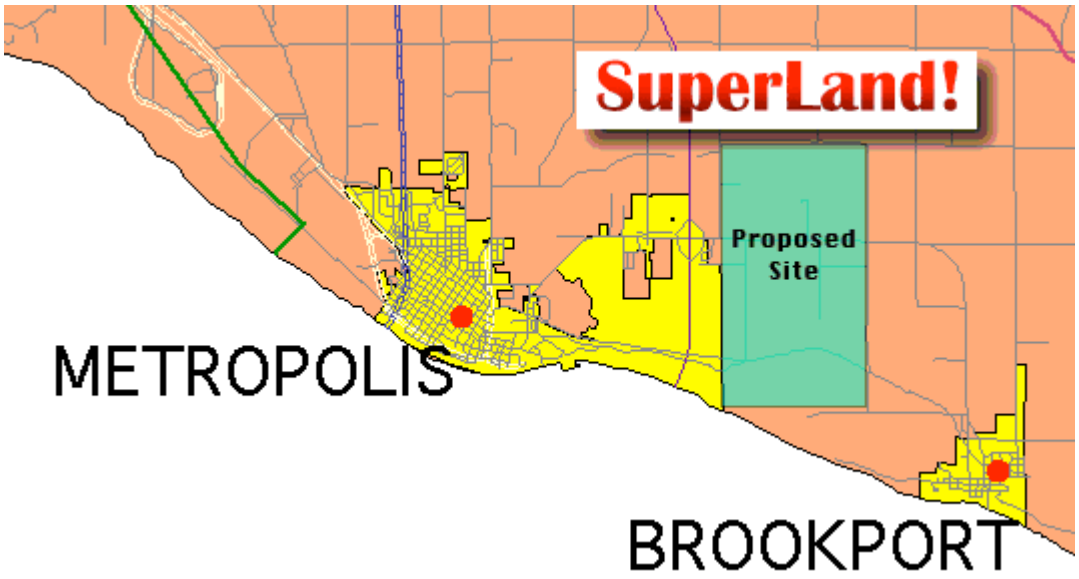
Due to the enormous costs involved in building this park, outside investors were sought. A group of very wealthy businessmen from Kobe, Japan, will provide 50% of the capital needed to build the park **if** the plans pass inspection.

One of their concerns is the safety (risk) of their investment from natural and man-made hazards.

The construction of the theme park will add over 2000 new jobs to the region, and when the park is completed and operational, more than 8,000 new jobs will have been created. Since this is presently an economically depressed area, these new jobs will bring prosperity to nearby communities. The taxes generated by SuperLand! will significantly improve the state treasuries of both Illinois and nearby states, like Kentucky. Tourism will increase the need for more hotels, motels, and restaurants, again creating more jobs. And, of course, the midwest will enjoy the theme park itself, with its many rides and attractions.

Your Involvement

The governor of Illinois and the Illinois State Legislature have created a panel of planning experts and scientists to look into the risks which may affect the new theme park. The panel consists of state agency scientists and some members of county agencies from southern Illinois. The scientists come from the Illinois State Geological Survey (ISGS), the Illinois Emergency Managment Agency (IEMA), and the Illinois Department of Natural Resources (DNR). Other representatives to the panel include a Metropolis Planning Commission member and a county board advisor.



The panel's task is to:

- determine which natural and man-made hazards may exist,
- evaluate how serious these risks are, either by themselves or in combination,
- if necessary or possible, propose plans which could reduce these risks to acceptable levels, and
- provide a final recommendation regarding whether or not the park should be built.

In effect, the panel will work to create a hazards and **risk assessment** report which will then be provided to the Illinois State Legislature and to the potential investors to aid them with deciding the fate of the proposed park.

Congratulations. You have been appointed by the governor to be a member of the **R**isk **A**ssessment and **M**itigation **P**anel for **S**uperland! **(RAMPS)**. You have received the attached letter welcoming you to the task force.

RAMPS Invitation letter

You will find some important links below. These links are intended to get you started ... they are far from being a complete resource.

Letters to Ramp

Recommended Search Engines

Federal Government web sites

State of Illinois sites

Non-governmental web sites

Principles of Risk Assessment

List O' Links (updated daily)

IMSA Geographic Information System

Disclaimer

If you are reading this from a printed page, please know that the SuperLand!/Metropolis problem has been designed and implemented for educational purposes only. This website and all of its compenent pages is an archive of student learning; it does not represent a real situation, but rather a real-world, ill-structured

problem-based learning experience.
For more information, please contact:

- **Edward Moyer, Jr.,** Summer 'AD'Ventures I Academic Program Coordinator, Illinois Mathematics and Science Academy at (630)907-5000 or moyer@imsa.edu

- **Michele Micetich**, Director, Statewide Collaborative Partnerships, Illinois Mathematics and Science Academy
at (630)907-5000 or micetich@imsa.edu

Assignment #4: The Philosophical and Historical Nature of Science

Objectives: Students will:

- Apply knowledge learned throughout semester of the nature of science through the use of a pretest/posttest.
- Discuss the Nature of Science Case Studies
- Answer open-ended questions regarding the nature of science

In order to complete this assignment, students will demonstrate knowledge of the nature of science throughout the semester by taking a pretest at the beginning of the semester and then a posttest at the end of the semester. The test that will be administered for both tests will be the Nature of Science Literacy Test (**NOSLiT**). The pretest will consist of thirty-five questions taken from the NOSLiT test. The posttest will consist of thirty-five questions, many consistent with the questions taken from the pretest. Questions will be altered in minor ways; the main ideas will be kept the same. This test will not be used directly to determine student's grades. All 35 questions will be used during the pretest and posttest in order to maintain the reliability of the test.

The nature of science will be instilled in every class applicable. When ever there is time to discuss the nature of science, the opportunity will be taken advantage of.

*In order to promote student thinking regarding the nature of science, *Nature of Science Case Studies* will be used at the end of class; whenever there is five to ten minutes left. This way, students will effectively use class time to discuss the nature of science.

The NOSLiT test has been printed off and put in STEP 3 Binder; just have to print off copies for class

Assignment #5: The Practice of Scientific Inquiry

Objectives: Students will:

- Design an experiment to find the relationship between force and mass; force and acceleration; or mass and acceleration
- Conduct and carry out the experiment they design
- Whiteboard their results and present their findings to the class
- Have an ongoing interaction with inquiry-oriented lessons and labs throughout the semester

For this particular assignment, the students will be actively engaged in an inquiry lab regarding the relationships between force, mass and acceleration. Students will be engaged in inquiry throughout the entirety of my student teaching experience. In order to assess whether or not the students have learned about inquiry through my experience, a pre/post-test will be used to assess the students. Students will be assessed through the use of the **ScInqLiT** test during the first week of student teaching and then ScInqLiT will be administered again during the end of the semester. Students will also be assessed their individual participation, lab report that is typed and meets the standards of the scoring rubric, and their white board presentation (as well as peer assessment). A sample of the lesson plans that will be used in alignment with inquiry lessons follows below. See below lesson plan:

Inquiry Lesson: Force, mass & acceleration

Title: Newton's 2nd Law ➔ $F = ma$

Overview: This 50-minute inquiry lesson is designed to get students started working in the area of dynamics. It is assumed that the students have a working knowledge of the following:

• Kinematics
• Graphical Analysis
• Graphical methods
• Dimensional analysis

Central Focus Question(s): What are the relationship between and among mass, force and acceleration?

Performance Objectives:
Students will:

- Design an experiment to find the relationship between force and mass; force and acceleration; or mass and acceleration
- Conduct and carry out the experiment they design
- Whiteboard their results and present their findings to the class

Anticipatory Set: This lesson will be linked to motion by conducting a quick review of what students know and then asking what role force places in constant velocity and accelerated motion. I'll also attempt to elicit known preconceptions relating force to motion (see below).

Process: Once the students are engaged in the project through the activities of the anticipatory set, I'll pursue the following steps:

1. Allow students to view materials
2. Elicit definition of force, acceleration and mass
3. Have students design an experiment with the materials provided to find the relationships between force, mass and acceleration of a cart on a *frictionless surface*
4. Each group of students only performs one of the experiments to show the relationship between their two variables.
5. Students whiteboard their results by drawing a graph on the whiteboard and then by interpreting the meaning of the graph.

*Go slowly here because the students are not experts when it comes to interpreting the slopes and meanings of graphs!

6. Encourage Socratic dialoguing between students

Closure: Have students make their conclusions regarding the relationships between F,m, and a while whiteboarding.

Assessment: The main form of assessment will be through the use of the **ScInqLiT** test. Students will take this exam after the lab has been completed. Students will be assessed on participation, a lab report that is typed, and their white board presentation (as well as peer assessment). A specific scoring rubric will be used for participation (See below for details). The rubric may be obtained at ➔ http://phy.ilstu.edu/pte/310content/partrubric.html

Preconceptions: I'll attempt to elicit the following alternative conceptions during the anticipatory set:
• Force is required to keep an object in a constant state of motion under any circumstance.
• If an object is at rest, no forces are acting upon it.
• Forces are only imparted via direct contact between two objects.
• Force always results in perceptible motion.

Materials: weight sets, Pasco frictionless carts/tracks, pulley, device to measure velocity or acceleration.

Assignment #6: Issues Related to Science and Technology

Objectives: Students will:

- Identify possible consequences of the loss of the Earth's magnetic field
- Discuss how the consequences will affect technology and other aspects of the world.
- Analyze the affects and discuss if they are a real possibility.
- Discuss the possibility and effects magnetic shielding has on the object it shields as well as other objects.
- Write an essay which integrates their outside research and the class discussion.
- Come to a conclusion with regards to the loss of the Earth's magnetic field, and what that means for future generations.

The instructor will bring in an article that states from scientific study that the Earth's magnetic field is going to "flip." The article below will be read aloud and students will be charged with the task of taking a side regarding whether or not the flipping of the Earth's magnetic field will disrupt life on earth (regarding communication, technology, animal life, and navigation). Students will present their side to the class as a classroom discussion/debate.
**Students will also have to research the opposing side in order to debate the other side's claims.*
Students will be discussing the consequences that are associated with the loss of the Earth's magnetic field. There is evidence that this phenomenon is going to happen. This activity will take place at the end of the unit on magnetism, once the students have a solid background in the area of magnetism. They will already know that the Earth has its own magnetic field and also the advantages of the magnetic field.
Students will be assessed based on their participation during the discussion/debate and by their peers. After class, students will be assigned to write a short essay. Students must research journals, newspapers, or internet articles and write a *mini* essay with regards to their findings. They must summarize what the article states

regarding the disappearance/prevalence of the Earth's magnetic field and integrate the information from the article with the discussion which took place.
The essay will be assessed using an essay scoring rubric Ryan Ellison with special consideration taken from Carl Wenning's Essay Scoring Rubric. The Essay Scoring Rubric can be found below.

Essay Scoring Rubric

	0 points (failing)	1 point (poor)	2 points (fair)	3 points (good)	pts
Organization (addend)	Thesis statement, introduction, body and closing essentially indistinguishable; mostly specific information with few generalities; disorganized.	Has some of the essential components but is disorganized; no real movement from generalities to specifics; somewhat disorganized.	Has all the essential components, but is somewhat disorganized; moves generally from generalities to specifics.	Thesis statement, introduction, body and closing clearly discernable: essay moves generally from generalities to specifics.	
Writing Style (addend)	Too familiar (e.g. repeated use of "you"); rambling commentary; poorly formulated paragraphs	Mixed style; mostly too familiar; some-what professional, and/or poorly formulated paragraphs.	Mixed style; mostly professional; somewhat too familiar; well formulated paragraphs.	Suitable for journal publication with a few minor revisions; well formulated paragraphs.	
Clarity (addend)	Poorly written; a number of major and minor grammatical errors; essentially unreadable; paragraphs are a jumble of sentences and sentences are a jumble of words; gibberish; key points missing and/or not elaborated.	Tolerably well written; a fair number of minor grammatical errors; a few major errors; confusing to reader; no evidence of regular review and revision; key points are made, but not often elaborated.	Reasonably well written; a few minor grammatical errors; easy and interesting reading; evidence of regular revision and proof reading; key points are made, but not always elaborated.	Well written; no grammatical errors; easy and interesting reading; clear evidence of regular revision & proofing; key ideas are fully elaborated and illustrate what is meant; examples are provided as appropriate.	
Relevance (addend)	Arguments are not cogent, concise, and relevant; few arguments are given and they are poorly reasoned, and insufficient to the task.	Arguments are not always cogent, concise, and relevant; many arguments are given but they are poorly reasoned; reader unconvinced.	Most arguments are cogent, concise, and relevant; a small number of arguments provided and all are well reasoned; reader uncertain.	All statements are relevant to the topic or bear on the question at hand; assists in clarifying topic or resolving issue.	
Depth (addend)	Address few if any of the main factors that make this topic important; clearly lacks evidence of appropriate review of resources.	Addresses some of the main factors that make this topic important; shows some evidence of review of two or more resources.	Addresses most of the main factors that make this topic important; shows evidence of review of several resources.	Fully addresses main factors that make the topic important; deals with complexities; identifies difficulties; shows evidence of review of several major critical resources.	
Grammar (addend)	Numerous spelling and/or punctuation errors.	A modest number of spelling and punctuation errors.	No spelling errors, and only a few punctuation errors.	Insignificant number of punctuation errors; no spelling errors.	

Format & Appearance (addend)	Gross violation of format guidelines dealing with font, font size, line spacing, and border areas; poor print quality.	Fails to meet two or three guidelines of appropriate font, font size, line spacing, and border areas; fair print quality.	Fails to meet one the guidelines for appropriate font, font size, line spacing, and border areas; good print quality.	Uses appropriate font, font size, line spacing, and border areas; good layout; good print quality.	
				Sum of Addends:	/18
Integrity (multiplier on sum of addends)	Clearly plagiarized; no citation provided at all; uses quotes as bulk of essay with or without credit. (0X)	Essentially plagiarized; large amounts of direct quoting even though reference(s) provided. (0.5X)	Essay not far from plagiarized; mere rearrangement of words; no evidence of own creativity. (0.7X)	Clearly work of student; makes appropriate use of references and citations. (1X)	
General Comments:				**Raw Score:**	/18

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Earth's Magnetic Field Is Fading

John Roach
for National Geographic News
September 9, 2004

Earth's magnetic field is fading. Today it is about 10 percent weaker than it was when German mathematician Carl Friedrich Gauss started keeping tabs on it in 1845, scientists say.

If the trend continues, the field may collapse altogether and then reverse. Compasses would point south instead of north.

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Lobsters Navigate by Magnetism, Study Says

Not surprisingly, Hollywood has already seized on this new twist in the natural-disaster genre. Last year Tinseltown released *The Core*, a film in which the collapse

disaster genre. Last year Tinseltown released *The Core,* a film in which the collapse of Earth's magnetic field leads to massive electrical storms, blasts of solar radiation, and birds incapable of navigation.

Entertainment value aside, the portrayal wasn't accurate, according to scientists who say the phenomenon of Earth's fading magnetic field is no cause to worry.

"The field has reversed many times in the past, and life didn't stop," said Gary Glatzmaier, an earth scientist and magnetic field expert at the University of California, Santa Cruz.

Glatzmaier is keeping an eye on our planet's weakening magnetic field as he tries to learn more about how Earth's geodynamo works. The geodynamo is the mechanism that creates our planet's magnetic field, maintains it, and causes it to reverse.

Magnetic Shield

Earth's geodynamo creates a magnetic field that shields most of the habited parts of our planet from charged particles that come mostly from the sun. The field deflects the speeding particles toward Earth's Poles.

Without our planet's magnetic field, Earth would be subjected to more cosmic radiation. The increase could knock out power grids, scramble the communications systems on spacecraft, temporarily widen atmospheric ozone holes, and generate more aurora activity.

A number of Earth's creatures, including some birds, turtles, and bees, rely on Earth's magnetic field to navigate. The field is in constant flux, scientists say. But even without it, life on Earth will continue, researchers say.

"There are small fluctuations, which lead to nothing, and large ones, which we know from the geologic record are associated with reversals," said Peter Olson, a geophysicist at Johns Hopkins University in Baltimore, Maryland.

When molten lava erupts onto the Earth's crust and hardens, it preserves a snapshot of Earth's polarity, much in the way that iron filings on a piece of cardboard align themselves to the field of a magnet held beneath it.

According to Earth's geologic record, our planet's magnetic field flips, on average, about once every 200,000 years. The time between reversals varies widely, however. The last time Earth's magnetic field flipped was about 780,000 years ago.

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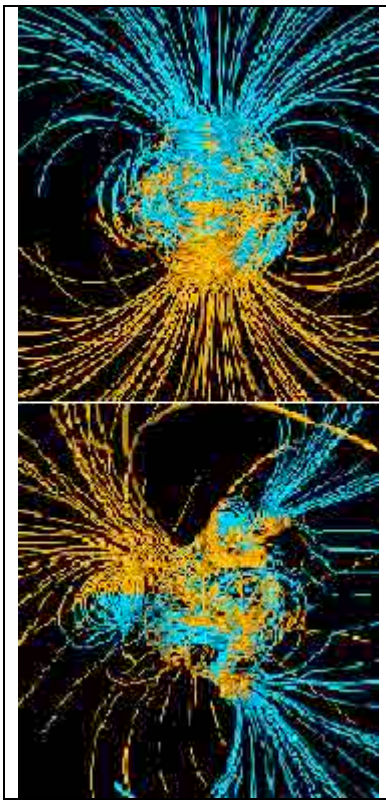
Lobsters Navigate by Magnetism, Study Says

"We hear the magnetic field today looks like it is decreasing and might reverse. What we don't hear is it is on a time scale of thousands of years," Glatzmaier said. "It's nothing we'll experience in our lifetime."

But several generations from now, humans just may witness a reversal. By then, Glatzmaier said, scientists will better understand the process and be prepared to cope with the effects.



Left top: A simulation of Earth's magnetic field structure.

Left Bottom: An image of what Earth's magnetic field might look like during a reversal, something humans may have to worry about thousands of years from now.

Images courtesy Gary Glatzmaier

http://news.nationalgeographic.com/news/2004/09/0909_040909_earthmagfield.html

Assignment #7: Science in the Community

Objectives: Students will:

- Consult with members of the community in order to develop an apparatus that can protect a raw egg from breaking from at least 2.0 meters
- Design the apparatus that houses the egg (specifications for the housing unit are listed below)
- Test their apparatus

In order to incorporate science into the community, students will be asked to develop a housing unit that will protect an egg from breaking when dropped from 2.0 meters. Any apparatus that survives the fall from a higher height will gain extra credit. Students will be encouraged to seek outside help from engineering firms and any other persons that may be of assistance. Parents are encouraged to participate in the building portion of the apparatus.

Specifications: The housing unit may not exceed 7.5 cm^3. Each egg will be tested for rawness (by spinning it and then stopping it; the egg should continue to spin if it is still raw). Students must build apparatus to specifications, bring in their own egg (for testing), and survive the height of 2.0 meters to receive full credit for the project. Eggs that exceed the minimum height specifications will receive extra credit. The maximum height that can be achieved is 8.5 meters (using a lift inside of the gymnasium).

ALTERNATIVE Assignment #7: Science in the Community

Objectives: Students will:

- Describe how hospital laboratory equipment uses the fundamentals and principles of physics in their daily operation
- Summarize how a magnetic resonance imaging (MIR) system is used in a hospital setting; and also what it does.

In order to incorporate science in the community in my classroom, I will ask students to ask their parents to come in and talk about their professions relating to electricity and magnetism. Parents in the medical field would be extremely useful in order to give a talk about the workings of magnetic resonance imaging equipment.

In the event that no one's parents have professions that incorporate electricity or magnetism, I will contact Fermi Lab (which is fifteen miles down the road) and ask if a scientist might come into the classroom and talk about the workings of the electron accelerator. In this case, I will require students to research Fermi Lab, and come up with any pertinent questions they may have to ask the scientist when s/he comes to give a talk.

If *plan B* doesn't work, one of my colleagues had a physics professor in college that now works for the Department of Defense. He and his team has been working on Terminal High Altitude Area Defense, or THAAD. THAAD destroys ICBMs through the use of kinetic energy. I would ask that he come in and give a talk about his team's success and how this technology relates to our world and community.

Students will write a short essay of what they researched before the talk, what they wanted to find out about Fermi Lab/or the parent's profession, and what they learned from the speaker in regards to Fermi Lab. The essay will be assessed using an essay scoring rubric Ryan Ellison with special consideration taken from Carl Wenning's Essay Scoring Rubric. The Essay Scoring Rubric can be found below.

Essay Scoring Rubric

	0 points (failing)	1 point (poor)	2 points (fair)	3 points (good)	pts
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General Comments:				**Raw Score:**	/18

III. CLASSROOM ENVIRONMENT

In order to create a student-centered environment, I will tailor my planning, teaching and assessment to the needs and abilities of my students. To do this, I will try to make every topic relate to their lives so that the topic at hand has more meaning and relevance than simply plugging numbers into an equation and finding the answer to puzzles at the end of a chapter. I believe that students will have a higher motivation to learn if they feel they have a real stake in their own learning.

An assessment-centered learning environment is one which focuses on formative assessment to improve both teaching and learning. Formative assessment is an ongoing assessment that is designed to make the students' thinking transparent to the teachers as well as the students themselves. This is an excellent way to elicit students' preconceptions as well as address them. In an assessment centered learning environment, students should be provided opportunity to express understanding, share feedback with one another, and reflect on their own learning.

According to the book, *How People Learn*, a knowledge-centered learning environment is characterized by learning with understanding and includes the explicit instruction and integration of metacognitive skills. A knowledge-centered learning environment focuses on depth of knowledge, high levels of interaction between the teacher and student as well as student-student interaction. It also focuses on higher order thinking skills that will assist them in their everyday lives. Knowledge-centered environments also focus on integrating metacognitive skills.

A community-centered learning environment is also an intricate part of the learning environment. Especially important are norms for people learning from one another and continually attempting to improve. We use the term community centered to refer to several aspects of community, including the classroom as a community, the school as a community, and the degree to which students, teachers, and administers feel connected to the larger community of homes, businesses, states, the nation, and even the world. A major thing that I will do to make my classroom more community-centered will be to have the kids feel okay to make mistakes. If they are not afraid to make mistakes, they will more likely to raise their hands and contribute to classroom discussions. A sense of community in the classroom is affected by grading practices. These grading practices can have positive or negative effects; mainly depending of the students.

Through the use of inquiry in the classroom, all classroom environments that are conducive toward learning are utilized with the use of inquiry. Higher order thinking skills are employed when inquiry is used in the classroom. Also, students become more scientifically literate because they are able to think for themselves and able to solve problems. That's what inquiry does; it allows students to learn how to think and solve problems for themselves.

I believe that it is extremely important to focus on the role of climate setting in that many people, including students, parents, and even fellow teachers resist the change to inquiry as an effective method for teaching physics. I think that an effective method for climate setting can at least persuade people to give inquiry a chance. Once people see the benefits of inquiry, a lot of new and exciting things can take place in the classroom. I will also be taking seminars and other workshops during my free time that are inquiry-oriented. This may be the time to take an administrator or fellow teacher along to introduce them to inquiry. I also have an entire PowerPoint presentation put together from my fellow colleagues in PHY 312 (Ad Hoc Committee) that focuses on why inquiry should not be dismissed so quickly. I will always be able to refer to that when ever the time comes.