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Lesson Module
Research Experience for Teachers (RET)
Summer 2007

A Step Towards Discovery: Inquiry Skills in Science

Appropriate Subject Area(s):

Good to develop engineering skills and fosters critical thinking within a group. Therefore it would be useful in presenting the scientific method or engineering processes throughout any of the science content areas (7-10). This module would be most appropriate in a physical science curriculum. It would need to be amended for a higher level curriculum.

Rationale:

This is a representation of a rudimentary engineering problem. It will help students develop inquiry and problem solving skills. This activity also creates a cross-curricular connection between science and math.

Learning Objective(s):

- To use the scientific method to reverse engineer a simple gadget.
- To make connections between Math and Science.

Standard(s) & Indicator(s):

This is directly related to the New Jersey Core Curriculum Standards 5.1, 5.3 and 5.7 in science.

This would include:

- 5.1A Habits of Mind,
- 5.1B Inquiry and Problem Solving,
- 5.3B Geometry and Measurement and
- 5.7A Motion and Forces.

Materials:

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| • Blue Books
(to be used as engineering journals) | • Rulers |
| • Mailing Tubes | • Scales |
| • Circular binder rings | • Mailing Tube ends |
| • Scissors | • Rope |
| | • Assorted of items not used in
gadget. |
- (these are meant to confuse students)

Approximate Time Required:

Two forty-minute periods. Time outside of class will be required.

List of Handouts:

- Lecture notes.
- Handout on Scientific Inquiry Process.
- Handout on Engineering Inquiry Process.

Background Information:

The teacher should give a brief discussion comparing the *Science Inquiry Process* (scientific method) with the *Engineering Design Process*. If applicable, review of the use of scales and measurement will be needed.

The “gadget” proposed is not used for any particular purpose.

Classroom Activity Description (Laboratory/Exercise/Problems):

- Brief lecture on the scientific inquiry process. This should include the steps involved in the scientific method (with accompanying notes). Comparison of the scientific inquiry process and the engineering inquiry process should be given now.
- After the introduction of the scientific method, place students into groups of two or three students.
- Each student should be given a bluebook to use as an engineering journal.
- Introduce the gadget to the students at this moment. Display the effects of pulling the ropes on the rope lengths at the corresponding corners. Explain that this gadget is a hypothetical apparatus found on a extra-terrestrial space craft. The objective for the students is to duplicate this Gadget.
- Provide a 10 min brainstorming session to manipulate and understand the gadget. Using their engineering journal, record the discussions of brainstorming activity. The student should also produce a drawing of their idea of what the Gadget is.
- Present students with a box with all the material to reproduce the gadget. Add other materials into opportunities to insure students are acquiring the right materials on their own.
- Have students replicate the gadget.
- It should have the following parameters.
 - A. Tube needs to be same length.
 - B. Same mass within +/- 3 grams.
 - C. Ropes needs to be within +/- 2 cm.
- Have class time for students to present their models of the gadget and explain the logic behind their designs.

Homework/Exercises/Problems:

Problems: a) collect all data on both mailing tube and rope. (Length, circumference)
b) Have students find the volume of the tube.

Assessment of Learning Outcomes:

- Engineering Journals (bluebooks) will be collected.
- Accuracy of the replica will be assessed.
- Rubric that takes into account a student's ability for teamwork and a peer review of the replica.