Teaching Engineering Applications in Math and Science (TEAMS)
Template: Math/Science-Engineering connected Lesson Plan

Title of Lesson:	Buoyancy
Date:	Summer 2009
Author's Name:	Dr. Joel Cahoon, Ph.D., P.E.
Grade level:	8
Content or Subject Area's:	Mathematics and physics applied to water resources engineering.
Duration of lesson:	2 to 5 hours

General Objectives:	One clear sentence addressing the scope of the lesson and curricular goal as relates to engineering.	The design of objects that float or are submerged in water must consider the buoyancy of the object.
Learning Outcomes: (1-3 stated outcomes) After completion of the lessons, students will be able to: (use action verbs)	What do you want students to know and be able to do? What knowledge, skills, strategies, and attitudes do you expect students to gain? What important math/science and engineering applications will students learn?	1. Represent the external forces on a simple object as a free-body diagram. 2. Use geometric relationships to determine the volume of a simple object. 3. Determine the buoyancy of a simple object analytically, and test the results experimentally.

State Standards: (MT Math and/or Science Standards)	End of Grade 8: M1-1,3,4,5; M2-1,3,4; M3-1,4,5; M4-1,2,5; M5-1,2,3,4,6 S2-5; S5-1
National standards: (AAAS Benchmarks)	End of the 8th Grade: 2B/M1; 3A/M3; 3B/M4a; 4D/M2; 4D/M10; 4F/M3a; 8B/M1

Materials and Resources:	Provide a list of materials, people, and references that 1) you used to create the lesson and 2) are required to teach the lesson, including all physical materials, sources and resources outside the classroom.	1) Not used to create the lesson, but a good introductory text is: Applied Fluid Mechanics. Robert L. Mott. Pearson/Prentice Hall. 6th Ed. 2006. 2) PowerPoint (or whiteboard/markers). A small bucket to hold water. Several small geometric shapes made from common material such as wood, plastic, brick or metal, having easily calculated volumes and a variety of unit weights.

Instructional Procedures: (include time estimates where possible)	Focusing Event: Why would your students care or want to know about this topic? What "big" questions will generate discussion about this topic?	Some things sink, some things float. Sometimes things that seem like they shouldn't float do - concrete canoe, battleship made of steel… Why?
	Teaching Methods and Student Activities: Sequentially list how you will carry out the various aspects of the lesson, including questions, examples, etc. What tasks will students complete? How will they build knowledge, skills, learn independently or with others? What instructional practices will you use with this lesson? How and where will your students work – labs, groups, stations?	This is all included in the PowerPoint presentation that will be used in the workshop. Included are notes and instructions for activities. The presentation is designed to be spread over 2 one-hour sessions for advanced students, or up to 5 one-hour sessions for beginning students. Students can complete the math portions of the activities individually but could work in groups for the hands-on portions.
	Closure: To review what has been learned, to do a final check for understanding of the skill or concepts and to focus on the connection between previous, future and current lessons.	At the end of this lesson, students should be able to compare buoyancy computations to observations using simple geometric shapes, and should be able to convey the concept to more complex geometries.

Evaluation procedures:	Describe your formative and/or summative assessment methods used in this lesson, your goals for using them, and how you will use the results. How will you know your students have reached the lesson goal? What assessment tools will you use? How will students be involved in ongoing assessment? How will students assess themselves?	This looks like the homework assignment for the teachers in the workshop. I have to be honest, I don't know the answers to these questions. JEC