“EXPLORATION” IN SCIENCE TEACHING  
(H. Weller – EDW 472/SMS 491 – Spring 2007)

EXPLORATION  
• The period of the student’s initial asking of questions when he or she experiences one or more phenomena of nature or the human-made world.

• “Messing about in science” : In good science teaching, there is a time, much greater in amount than commonly allowed, which should be devoted to free and unguided exploratory work (call it play, if you wish; I call it work). Children are given materials and equipment—things—and are allowed to construct, test, probe, and experiment without superimposed questions or instructions” (Hawkins, 1974, p. 67).

• “As a [learning] cycle of lessons begins, children are provided with opportunities for ‘exploring’ the materials of the lesson so that they get a ‘feel’ for the topic or phenomenon” (Hurd & Gallagher, 1968, p. 19).

• “… the first approach to any subject in school, if thought is to be aroused and not words acquired, should be as unscholastic as possible” (Dewey, 1916, p. 154).

THE POWER OF QUESTIONS  
• “The ability to ask the right question is more than half the battle of finding the answer.” –Thomas J. Watson

• “Once you have learned how to ask questions—relevant and appropriate and substantial questions—you have learned how to learn and no one can keep you from learning whatever you want or need to know” (Postman & Weingartner, 1969).

• “Every question possesses a power that does not lie in the answer.” --Elie Wiesel

• “I decided that during this morning’s jog I would relax my mind from its pedagogic tendency to conduct verification science. I would let nature ask me questions, and pursue them wherever they led me” (Weller, 1998, p. 390).

VISION: A GREAT TOOL OF EXPLORATION  
“Of all our senses it is vision that most informs the mind. … It is no wonder that the instruments of science also favor vision; but they extend it far into new domains of scale, of intensity, and of color” (Morrison & Morrison, 1994, p. 1).
THE CENTRAL STRATEGY FOR TEACHING SCIENCE

“Inquiry into authentic questions generated from student experiences is the central strategy for teaching science. Teachers focus predominantly on real phenomena, in classrooms, outdoors, or in laboratory settings, where students are given investigations or guided toward fashioning investigations that are demanding but within their capabilities” (National Research Council, 1996, p. 31). This statement is from the National Science Education Standards.

DISCOVERY IS NOT ALLOWED ENOUGH IN SCIENCE COURSES

“The processes of science as portrayed in the majority of elementary and secondary science textbooks have focused almost exclusively on activities associated with the context of testing [or verification]. What results then is an incomplete representation of science” (Duschl, 1990, p. 9).

“EXPLORATION” BY BRAINSTORMING QUESTIONS (GALAS, 1999)

“Students begin a new area of study by brainstorming ‘wonder’ questions, developing driving questions, and devising their own hypotheses and experiments in a student-centered design” (p. 11). After brainstorming questions and then asking 3-5 individual wonder questions, the students then categorize the questions: “They discuss [as a class] why a particular category is a good idea and defend their choice of category before the group with substantive reasons—otherwise the group may not accept the category” (p. 12). This process was used with 4th and 5th graders. It can also be used quite well with older students.

REFERENCES