

Inquiry and Problem Solving

MSED 320/538

IIT's Mathematics and Science Education Program

The overall conceptual framework for our program borrows heavily from Shulman's (1986) *Knowledge Growth in Teaching* with the ultimate focus on *the Teacher as Transformer of Subject Matter*. The program focuses on the development, revision, and elaboration of six primary domains of knowledge that both theory and research have indicated are essential for effective instruction. It is this combination of domains of knowledge that distinguishes the expert teacher from others possessing one or more of the following domains of knowledge.

- 1. Subject matter knowledge:** Knowledge of foundational ideas and conceptual schemes, data and procedures within a specific subject matter area.
- 2. Pedagogical knowledge:** Knowledge of generic principles and strategies of classroom instruction (e.g., instructional models and integration of technology) and management.
- 3. Knowledge of schools:** Knowledge of educational contexts, i.e., the place of the classroom in the school, school in the community and other social contexts.
- 4. Knowledge of learners:** Knowledge of all aspects of intellectual, social and emotional development of all students regardless of cultural, social, ethnic background.
- 5. Curricular knowledge:** Knowledge of development and implementation of programs and materials.
- 6. Pedagogical Content knowledge:** The way of representing and formulating subject matter knowledge that makes it comprehensible to others (i.e., knowledge of how to transform and represent subject matter so that it is comprehensible to students or others).

Course Description:

Inquiry and Problem Solving course is designed to provide students with opportunities to participate in authentic interdisciplinary inquiry and problem solving, while focusing on relating the inquiry experience to mathematics or science education. Students will reflect on aspects of inquiry/problem solving, and nature of science/mathematics. This course provides background for student development of instructional materials focusing on inquiry/problem solving and nature of science/mathematics for ALL students. The course aims to capitalize on the authentic experiences students have with inquiry and problem solving and/or other authentic inquiry based experiences.

Course Goals:

Each student will:

- Develop a functional understanding of scientific inquiry, problem solving and the nature of science and mathematics
- Use his/her understanding of scientific inquiry, problem solving and the nature of science/mathematics as a guiding framework for the development of laboratory activities, classroom demonstrations, and instructional materials.
- Develop an understanding of the relationship between the development of scientific/mathematical knowledge and how students learn.
- Develop the skills necessary for the development, implementation, and evaluation, of
- Laboratories, demonstrations, and materials.

Topical Sequence:

- What is Problem Solving/ What is Scientific Inquiry?
- Procedural knowledge vs. Conceptual knowledge
- What is Nature of Science/Mathematics?
- Connection to the state/ national reforms
- Effectively teaching PS and SI
- Effectively teaching Nature of Science/ Mathematics
- Assessing PS and SI
- Assessing Nature of Science / Mathematics
- Problem Based Learning
- Modifications and accommodations for all students
- Role of Technology in Problem Solving and Scientific Inquiry
- Student motivation and efficacy
- Relationship between math and science

Textbooks and Materials:

- (a) National Council of Teachers of Mathematics. (2000). Principles and Standards for School Mathematics. Reston, VA. : The National Council of Teachers of Mathematics, Inc.
- (b) National Council of Teachers of Mathematics (2007). Focal Points. Available at [http://my.nctm.org/products.xml?Catalog/Product\[13089 \]](http://my.nctm.org/products.xml?Catalog/Product[13089])
- (c) Selection of Science and Mathematics Trade Books
- (d) Various handouts will be distributed throughout the course
 - i. Lederman, J.S. and Stefanich, G.P. (2004). Addressing disabilities in the context of inquiry and nature of science instruction. In Flick, L.B. and Lederman, N.G. (Eds). *Scientific inquiry and nature of science*, 55-74. Netherlands: Kluwer Academic Publishers.

Evaluation:

Grades will be based upon total points received from:

Attendance and active, informed participation	10%
Reaction Papers / Written Assignments	30%
Book Reviews	60%

There will be no curve. Students will strive for predetermined levels of mastery rather than compete against each other. The levels of mastery are as follows:

90 -100% = A	60-69% = D
80 - 89% = B	< 60% = F
70 - 79% = C	

Accommodations:

Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources and make an appointment to speak with me as soon as possible. My

office hours are. . .

The Center for Disability Resources is located in the Life Sciences Building, room 218, 312-567-5744 or disabilities@iit.edu.

Resource Idea/Card Section Definitions and Inclusions

1. Title and Source/citation
2. **Idea:** An overview or brief description of the idea and its purpose
For example: Have students count stripes on sunflower seeds to illustrate a normal distribution.
3. **Connection to Standards:** Specify the National Standards or Benchmark that your Idea will help students achieve.
4. **Use:** Describe when and how the idea will actually be implemented within a lesson
For example: Please see sample resource idea/card
5. **Materials:** Specify the materials (class set or per student) that are needed for the idea
6. **Modifications:** Identify alternative uses of the idea or alternative materials if recommended materials are unavailable, and include modifications to address the diverse needs of the learners.

Resource Idea/Card Critique Sheet

Name _____

Grade _____

Overall Assessment:

1. I have used the following symbols at the top of each idea/card to indicate deficient items:

- 0 - Idea
 - \$ - Connection to Standards
 - √ - Use
 - * - Modifications
 - # - Materials
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2. Variety of Ideas (e.g., demonstrations, labs, pictures, bulletin board items, etc.)

3. Attention to inquiry/problem solving and the nature of science/mathematics.

4. General Comments: