

# Instructional Methods/Strategies I

## MSED 300 (3 credit hours)

### 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

This course is a discussion and laboratory oriented course focusing upon instructional planning, implementation considerations of various teaching methods, development of instructional activities, and assessment of student learning. This course is designed to allow students to develop the theoretical background, practical knowledge, and skills essential for successful mathematics/science teaching that addresses student diversity. Students are also provided with opportunities to practice instructional skills in peer teaching lessons. Specific emphasis will be placed upon instructional methods/modes, contemporary mathematics/science curriculum goals, instructional planning, assessment, and technology integration (e.g., probeware, Geometer Sketchpad, simulators, internet, Smartboard, Elmo, and calculators).

### Course Goals

The focus of this course is to provide students with the opportunity to:

- translate science /mathematics theory and research into practice
- analyze and challenge personal understandings of science and mathematics and the teaching of these disciplines
- further develop personal understandings of the nature of science and mathematics and specific science and mathematics content
- gain practice in the teaching of science and mathematics content in a manner which focuses on students' incoming understandings and natural curiosity
- practice the basic skills necessary to conceive and effectively implement a successful science and mathematics program in a secondary school setting.

## **Textbooks and Materials**

### **All:**

- (a) American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. New York: Oxford University Press. Website: <http://www.project2061.org/publications/bsl/online/bolintro.htm>
- (b) Stefanich, G. (2007). *Inclusive science strategies*. National Science Foundation: USA.
- (c) Stefanich, G. (2007). *Ontogeny of Inclusive Science*. National Science Foundation: USA.
- (d) International Technology Education Association (2000). *Standards for technological literacy*. Reston, VA: Author. Website: <http://www.iteaconnect.org/TAA/PDFs/xstnd.pdf>
- (e) Various handouts will be distributed throughout the course
  - i. Jerrett, D. (1999). *The inclusive classroom: Teaching mathematics and science to English-language learners. It's just good teaching*. Portland, OR: Northwest Regional Educational Laboratory.
  - ii. Eggen, P.D., Kauchak, D.P., Harder, R.J. (1979). *Strategies for teachers: Information processing models in the classroom* (102-141). Englewood Cliffs, NJ: Prentice-Hall, Inc.
  - iii. Tobin, K. and Tippins, D (1993). Constructivism as a referent for teaching and learning. In: K. Tobin (Ed) *The practice of constructivism in education* (3-21). Hillsdale, NJ: Lawrence-Erlbaum.

### **Math:**

- (a) Posamentier, A.S., Smith, B.S., & Stepelman, J. (2006). *Teaching secondary mathematics: Techniques and enrichment units* (7<sup>th</sup> ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- (b) National Council of Teachers of Mathematics. (2001). *Principles and standards for school mathematics*. Reston, VA: Author. Website: <http://standards.nctm.org/document/index.htm>

### **Science:**

- (a) Chiappetta, E.L., Koballa, T.R. (2006). *Science instruction in the middle and secondary schools*. (6<sup>th</sup> ed.). New Jersey: Merrill Prentice Hall.
- (b) National Research Council. (1996) *National science education standards*. Washington, D.C.: Author. Website: <http://www.nap.edu/readingroom/books/nses>

## **Topical Sequence**

- Goals and Curriculum Reform
- Foundations of Mathematics/Science
- Characterizing Effective Instruction
- Levels of Learning/Bloom's Taxonomy
- Instructional Planning
- Diversity and Equity: Teaching All students
- Resource Card Development
- Technology Integration
- Lecture/Recitation
- Demonstration
- Activities emphasizing technology as a way of adapting to the world
- Discussion

- Laboratory

### **Evaluation**

Grades will be based upon total points received from:

Instructional objectives  
Lesson plans (3)  
Peer teaching lessons (2)  
Resource cards (30)

There will be no curve. Students will strive for pre- determined 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](mailto: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.)
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3. Attention to inquiry/problem solving and the nature of science/mathematics.
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4. General Comments:

## **Demonstration Presentation**

### **MSED 300**

1. Select a demonstration from one of your science/mathematics teaching resources. The demonstration should accurately illustrate a concept from your content area as well as provide some focus on inquiry/problem solving and/or the nature of science/mathematics. Your task is to present the demonstration, explain how it works, and describe how it might be used in a secondary science class.
2. The demonstration and its explanation should take about 15-20 minutes. In addition, a handout including the following should be provided to the instructor and each member of the class:
  - Title
  - Source of Idea
  - Materials needed
  - Procedure and Instructions
  - An explanation of the demonstration: Concepts and Skills demonstrated as well as scientific explanation of phenomena
3. Your grade will be based on the following criteria:
  - Presentation on the scheduled day
  - Handouts provided for the class
  - Content accuracy of the demonstration
  - Emphasis on inquiry/problem solving and/or nature of science/mathematics
  - Adherence to “do’s and don’ts” of demonstrations
  - Accuracy of demonstration explanation
  - Appropriateness of demonstration for secondary students
  - Clean-up of materials
4. Although you will not be required to submit a lesson plan for this assignment, you are strongly urged to write one.

## Laboratory Presentation MSED 300

1. Select two partners to work with on this assignment. Together you will select, conduct, and evaluate a 50-minute lab for the rest of the class on your scheduled day.
2. Your grade will be based on the following criteria:
  - a) List of Responsibilities: There is a lot involved in the selection, planning, conduction, clean-up, and evaluation of a lab. Once you have selected your partner, you are asked to submit a listing of each partner's responsibilities.
  - b) Objectives and Evaluation Plans: A list of the specific objectives you expect to be met by this lab (both long term and short term), as well as your plans for evaluating students on these objectives, will need to be turned in **prior** to the presentation of this lab.
  - c) Presentation on the Scheduled Day: Rescheduling of the lab presentation will be difficult. Your only option is to trade days with another group.
  - d) Handouts: Handouts should be provided for each member of the class. These should include student copies, which will be used for the class, and a teacher copy with an answer key.
  - e) Content Accuracy: The topic you select to teach is up to your team. It is recommended that teams be composed of individuals with similar content areas. Your lab should teach your selected content with accuracy, encourage safe lab techniques, and should be appropriate for a secondary school audience.
  - f) Inquiry/Problem Solving and Nature of Science/Mathematics: In addition to the above, your lab should focus on inquiry (as opposed to being of the "cookbook" variety). Attention to the nature of science/mathematics is encouraged.
  - g) Lab Presentation: The actual presentation of the lab will be graded, but this is not the primary focus. Both members of the group will be required to present. Since a laboratory lesson includes three phases (pre-lab discussion, lab activity, and post-lab activity) it is recommended that one team member be responsible for the pre-lab, the other member for the post-lab, and both team members monitor the lab activity.
  - h) Clean-up: All materials used, both prior to the lab and after its completion need to be cleaned up and returned to the appropriate places. This clean-up should be completed within 48 hours after the lab is presented.
  - i) Evaluation of the Lab: You must follow through with the plans for evaluation which you **turned in prior to the lab**. Did you meet the objectives you set? What evidence do you have for this? Collect all student labs at the end of your lesson and use these to justify your evaluation. You may use any observations that you made during the lab to support your evaluation. An evaluation of your lab is due at the beginning of the next class meeting after your presentation.
  - j) Group Cooperation: Did all group members complete their share of the assignments?

## Notes on Teaching a Lab

### Pre-Lab Discussion:

1. Provide students with explicit instructions for the completion of the assigned task. No handout in existence is completely self-explanatory.
2. Verify understanding of these instructions by questioning the students.
3. Demonstrate appropriate procedures.
4. Discuss and demonstrate any relevant safety procedures.
5. Discuss any pertinent behavioral expectations.
6. Provide students with instructions for clean-up.
7. What are “early finishers” supposed to do?
8. Be sure to question students about the activity to assess their understanding of the pre-lab instructions.

### During the lab:

1. Be sure to monitor the progress of each group and/or individual.
2. Do not limit your attention to only those groups of students who ask for your help.
3. Attempt to establish contact with each student or group as soon as possible after the lab has started. Be sure that all students are off to a quick and appropriate start.
4. You should have planned questions, which you will ask of individuals and groups during the monitoring of the lab. It is incorrect to assume that students in need of assistance will ask for that help (or even know that they need the help).
5. Be sure to follow-up on your previously stated plans for clean-up and activities for “early finishers”.

### Post-Lab:

1. You should have planned review questions, which will help you, and the students summarize the results of the activity.
2. This is your closure/summary. Treat it as you would the closure/summary of any other lesson.