

**UNIVERSITY OF NORTH CAROLINA AT GREENSBORO**  
**School of Education**  
**Curriculum and Instruction Department**

*Be the change you wish to see in the world*  
-- Gandhi

**Operating Principles**

- Be present and open
- Actively listen to self and others
- Suspend certainty and judgment
- Ask clarifying questions
- Process and reflect on learning from each segment
- Make time for eating and have a sense of humor!

**COURSE SYLLABUS FALL 2005**

**Course Prefix and Number: CUI 664**

**Course Title: Teaching Problem Solving**

**Credits: 3 SH**

**Time: M 5 – 7:50**

**Place: Curry 332**

**Course prerequisites:** Admission to graduate studies in education or permission of instructor

**For who planned:** Students enrolled in Curriculum and Instruction Graduate programs

**Instructor Information:**

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**Office Hours:** Mondays and Wednesdays 2-4, after class and by appointment

**Course Purpose/Catalog Description:** Survey of methods and materials for teaching problem solving and evaluating problem solving performance of students. Development of instructional programs on problem solving and assessment of their effects.

**Teachers Academy conceptual framework mission statement:** *The mission of professional education at UNCG is to prepare and support the professional development of caring, collaborative, and competent educators who work in diverse settings. This mission is carried out in an environment that nurtures the active engagement of all participants, values individuals as well as cultural diversity and recognizes the importance of reflection and integration of theory and practice. UNCG's professional education programs are guided by shared commitments to: (a) equity and excellence in teaching, research, and service; (b) professional integrity and ethical deliberation in dealing with students and colleagues (university-based, school-based, and community-based); (c) the construction of a professional knowledge base through collaboration and collegiality; and (d) the dissemination of professional knowledge, skills and dispositions through the preparation and continuing professional development of teachers, principals and other school personnel.*

**Course Goals and/or Objectives/Student Learning Outcomes:** The course focuses on contemporary issues of mathematical problem solving. Problem Solving is not new. We will explore the definitions and nature of problem solving. We will explore the teaching of problem solving. We will develop instructional materials for use in facilitating students' problem solving, assess students' problem solving approaches in their use of the instructional materials, and assess their general heuristics for solving problems. Problem Solving can be conceptualized as a subset of learning and teaching for understanding and sense making. Teaching and Learning Mathematics for Understanding is not new, but it has been given the focus it deserves in recent years and is currently driving educational philosophy. We will explore how people, particularly K-12 students learn. I hope that we can use the exploration to reflect on and enhance the understanding of our educational interests and foci. Overall, this course should enable you to:

- a. analyze current ideas and research on learning through problem solving
- b. analyze current ideas and research on teaching through problem solving
- c. connect the analysis to particular educational issues that interests you
- d. gain further insights into the educational enterprise: Mathematics Education

**Teaching Strategies:** We will deploy document analysis, collaboration, cooperative group work, discussion, presentation/facilitation/moderation, electronic chat, electronic discussion, written assignments, and problem solving.

You will complete the following tasks during the semester:

- Read materials before we meet
- Summarize the main points and be ready to share
- Bring a question for discussion
- Respond to questions during discussions
- Take the lead in discussion
- Solve problems
- Design a deck/portfolio of problems

Interview a student and write it up

### **Evaluation Methods and Guidelines for Assessment:**

**Problem Deck Project:** You will be required to produce a portfolio of questions/tasks/problems. The questions/tasks/problems should engender deep thinking, should be amenable to multiple solution strategies, should be extendable, should be connected to the standards (NCTM and North Carolina) and that leaves behind an important mathematical residue as a result of resolving the tasks. You ought to discuss the relevance, importance and purpose of each of the tasks. The notion of mathematical residue is one way you can accomplish such a discussion. The tasks, connection to standards, solutions, descriptions, mathematical residue, cognitive demand of the problem, etc., should be printed on landscape letter sized sheets of paper. Use the APA style to format the citations and references. You will be expected to generate 10 serious problem solving questions/tasks/problems that you will use with your students. (40% of grade)

**Participation:** You will be expected to discuss readings on-line and face-to-face (f2f). I will ask you to develop discussion questions for class and lead the discussions. The discussions ought to focus on the readings. You will also present your project and lead us through the why, the how, the when, and so what questions that will arise in the discussion of your chosen items. Your participation grades will be surmised from your quality contributions to on-line and f2f discussions, your grasp of the reading, your ability to connect the readings to your interests, your exemplification of the implications of the readings in your project. You will also be expected to solve problems and assess the nature of the mathematical residues gained from the problems or potential mathematical residues that could be gained from the task. Grades for participation will also the final exam grades. (40% of grade)

**Interview Task:** You will interview a student and assess his/her problem solving heuristics. You will audiotape your interview. This means that you will have to gain consent from your student and his/her parents (if the student is a minor). You will select a series of tasks/problems for the student to complete. The tasks should be within the Zone of Proximal Development (ZPD) of the student. As the student completes the task, you will ask probing questions and ask the student to think-aloud so that you can record and assess the students' problem solving heuristics and his/her metacognitive processing. As you write up your assessment of the student, use quotes/vignettes to substantiate your claims. Use the APA style to format your paper. Use the reflection cycle to structure your discussion. (20% of your grade)

### **Grading Scale**

A:  $\geq 90\%$   
B:  $80 \leq \text{score} < 90$   
Unacceptable performance:  $< 80\%$

## **Texts for class**

- (1) Bransford, J. D., Brown, A. L., Cocking, R.R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school*. Washington, D. C.: National Academy Press. See [www.nap.edu](http://www.nap.edu)
- (2) Mason, J., Burton, L., and Stacey, K. (1985). *Thinking mathematically*. Reading, MA: Addison-Wesley Publication Company.
- (3) Polya, G. (1945). *How to solve it: A new aspect of mathematical method*. Princeton, NJ: Princeton University Press.
- (4) Schoen, H. L., Charles, R. I. (Eds.) (2003). *Teaching mathematics through problem solving: Grades 6-12*. Reston, VA: National Council of Teachers of Mathematics.
- (5) Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H., et al. (1997). *Making sense: Teaching and learning mathematics with understanding*. Portsmouth, NH: Heinemann.
- (6) Stein, M. K., Smith, M. S., Henningsen, M. A., Silver, E. A. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development*. New York, NY: Teachers College Press.

## **TENTATIVE OUTLINE: SUBJECT TO CHANGE BASED ON STUDENTS' INTERESTS**

### **Week 1 August 15: Introduction/Overview/Goals**

Introductions/Overview/Goals

What is a problem?

What is problem solving?

Solve problems

Focus on the Mathematical Residue:

What prior learning?

What is the mathematics at hand?

What does the present learning prepare me to be able to do in the future?

Homework:

(1) Read *Analyzing Mathematics Instructional Tasks* Handout

**To be handed in for grade:**

(2) Prepare your definition of problem solving

(3) Provide two other definitions (include references to the sources)

### **Week 2 August 22: Rich Problems/Cognitively Demanding Tasks**

Mathematical Task Framework

Task Sort

**Week 3 August 29: How People Learn** [www.nap.edu](http://www.nap.edu)

Reading: Pages 1 - 113, and pages 131 - 154

***Online BB Session***

I will be at a TIMSS Worksession on Algebra at NEA in Virginia.

**Week 4 September 5: (Labor Day: No Class)**

**Reading Due: September 9 by 5 p.m.**

- How People Learn [www.nap.edu](http://www.nap.edu)

**Week 5 September 12: Polya and Problem Solving, & Thinking Mathematically**

Reading and Assignment (TBA)

**Week 6 September 19: Thinking Mathematically**

Reading and Assignment (TBA)

**Week 7 September 26: Thinking Mathematically**

Reading and Assignment (TBA)

**Week 8 October 3: Thinking Mathematically**

Reading and Assignment (TBA)

**Week 9 October 10: (Fall Break: No Class)**

**October 13 – 14: North Carolina Council of Teachers of Mathematics Annual Meeting**

**Koury Convention Center, Greensboro, NC**

<http://www.ncctm.org>

**Week 10 October 17: Teaching Mathematics through Problem Solving & Making Sense**

Reading and Assignment (TBA)

**Week 11 October 24: Teaching Mathematics through Problem Solving & Making Sense**

Reading and Assignment (TBA)

**Week 12 October 31: Teaching Mathematics through Problem Solving & Making Sense**

Reading and Assignment (TBA)

**Week 13 November 7: Teaching Mathematics through Problem Solving & Making Sense**

Reading and Assignment (TBA)

**Week 14 November 14: *Teaching Mathematics through Problem Solving & Making Sense***

One 50-minute Presentation and debriefing

Take-Home Final (part of your participation grade)

**Reflection on the readings, the interview, how you have used the ideas with your students, and how you intend to use the ideas in your work in the future**

**Interview Task Due Today**

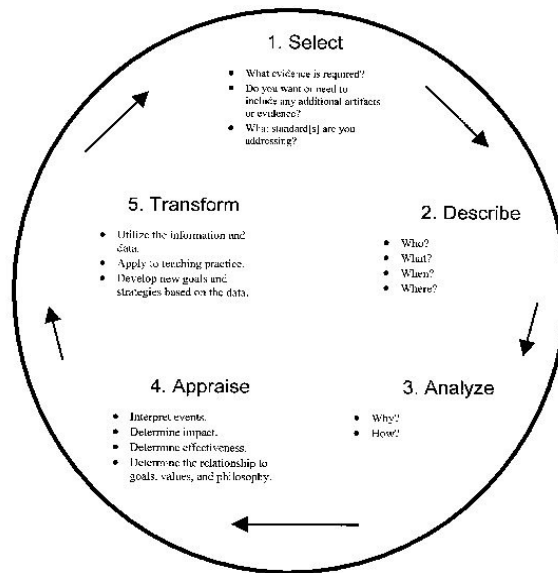
**Week 15 November 21: *50-minute Presentations and debriefing***

**Week 16 November 28: *50-minute Presentations and debriefing***

**Problem Deck Due Today**

**Week 17 December 5:      *Final Reflections and debriefing*  
*Take-Home Final Due***

## NCDPI Reflection Cycle



### The Reflection Cycle

#### Select:

Identify the artifact (use reference citation, name, or code)

#### Describe:

What are the main points of the assigned reading?

What claims, theories, examples, conclusions, and questions are posed?

#### Analyze:

Why is this important?

How is *learning mathematics and teaching mathematics with understanding and sense making* implicated?

#### Appraise:

In the previous three steps, you have described and analyzed an assigned reading. The actual self-assessment occurs at this stage as you interpret the reading and evaluate its appropriateness and impact, relative to your educational experience and educational interests. What shocked you? What made you question your prior conceptions?

#### Transform:

This step holds the greatest opportunity for growth as you use the insights gained from reflection in improving and transforming your practice. How will you use the information to inform your practice or theoretical position?