Title
Fostering Cooperative Learning, Discussion, and Critical Thinking in Elementary Math (Grades 1-5)

Target Audience
This course is intended for pre-service and in-service grades 1-5 teachers.

Course Description
This course presents model elementary math lessons and activities that incorporate cooperative learning, critical thinking, and problem solving enhanced by today's classroom technology. Learners will explore software and Web activities specifically designed to support collaboration and problem solving within the math curriculum, and help students meet the National Council of Teachers of Mathematics (NCTM) Principles and Standards. The NCTM Principles and Standards for School Mathematics state, "Communication is an essential part of mathematics and mathematics education." Activities will be explored that help students organize and consolidate their thinking, communicate their ideas clearly to others, analyze and evaluate the ideas of others, and use the language of mathematics to precisely express mathematical ideas. At the end of the course, learners will develop one technology-integrated lesson plan ready for immediate implementation that addresses one topic in the math curriculum using teamwork, discussion, and critical thinking.

Instructor/Facilitator
See instructor/facilitator sheet

Credits
To be determined by college or university

Goals
By the end of this course, learners will:

• Understand how cooperative learning, communication, and critical thinking can increase student learning of mathematics.
• Analyze math lessons to identify the critical-thinking skills and strategies developed.
• Incorporate higher-level thinking questions into math discussions.
• Use technology to teach mathematics lessons incorporating cooperative learning, discussion, and critical thinking.
• Develop lessons that incorporate features of successful cooperative learning and problem solving in context.

Outline of Assignments
A summary of course content and assignments is outlined below:
Session 1: Collaboration, Discussion, and Critical Thinking

The learners will:

- Define their professional goals and expectations for this course.
- Explain their prior knowledge and experiences with collaboration, inquiry, and critical thinking skills.
- Reflect on classroom practices and math lessons incorporating teamwork, discussion, and critical thinking.
- Discuss cooperative learning with online classmates.

The learners will:

Read
- “Cooperative Learning,” by David A. Dockterman, Ed.D.

Watch videos
- "Using Elementary Graphing Programs"

Reflect in journal
- Analyze their own expectations for this course by setting professional goals.
- Analyze their prior knowledge of this topic by responding to the following: What are ways that you have incorporated collaboration, discussion, and critical thinking into your elementary mathematics classroom? What were the challenges? What were the successes?

Participate in online discussions
- Introduce themselves to their fellow learners in the Virtual Café
- What are the benefits and/or challenges to cooperative learning? What have your experiences been?

Complete activities and assignments
- Complete the Pre-Course Evaluation Survey

Session 2: Thinking and Talking About Math

The learners will:

- Reflect on how students think critically in the classroom
- Identify the critical-thinking skills and determine how they apply to mathematics
- Determine ways to incorporate critical thinking into mathematics lessons

Read
- “Critical Thinking: What It Is and Why It Counts,” by Peter Facione (pp. 1-6)
- “Strategies for Teaching Critical Thinking,” ERIC/AE Digest (Potts, 1994)

Watch videos
- “Engaged with Technology”
- “Meeting the Standards”
- “Technology and Critical Thinking”

Explore Web sites
- NCTM Standards for School Mathematics
- NCTM Principles and Standards for School Mathematics – Communication
Session 3: Problem Solving and Cooperative Learning

The learners will:

- Identify components of successful learning
- Determine the critical-thinking skills that are essential for students to successfully solve mathematical story problems
- Examine lessons using Interactive Group Software and the Internet
- Determine the benefits of using technology for problem solving and cooperative learning
- Create and peer-review a technology-based math activity that applies the three components of cooperative learning

Read
- “Harvard Education Letter—Putting Cooperative Learning to the Test”

Watch videos
- “Interactive Group Software: Fizz & Martina’s Math Adventures”

Explore and analyze either of the following Web activities
- Lemonade Stand
- Lemonade Stand Game

Explore Web sites
- Aunty Math

Reflect in journal
- How do you feel about cooperative learning in your math classroom? Write your initial thoughts about using cooperative learning as a strategy to teach math.

Participate in the online discussion
- Post the description of your technology-based math activity from the Cooperative Math Assignment. Then, peer-review another learner's activity.

Complete activities and assignments
- Cooperative Math Assignment

Session 4: Using the Web for Teamwork
The learners will:

- Analyze Internet lessons to determine the higher-level thinking and math skills they teach.
- Create student discussion questions for Web projects that require higher-level thinking skills.
- Determine the characteristics of effective Web projects.
- Analyze and select Web projects appropriate for developing student critical-thinking skills.
- Analyze and reflect about the implementation of a Web lesson in your classroom.

Read
- “I Lost My Tooth”
- Characteristics of Effective Student Web Projects

Watch videos
- “Web Projects”

Explore Web sites
- Global SchoolNet’s Internet Project Registry
- Telecollaboration Projects You Can Join
- MathMagic!
- “Quality Assurance Guidelines for Online Projects” from Oz Projects
- Let’s Make a Deal Math: The Study of Probability
- Solve It! (PDF taken from Net Lessons)
- AppleWorks Charts & Graphs WalkThrough
- Microsoft Excel Charts & Graphs WalkThrough
- Create a Graph

Reflect in journal
- How do you encourage critical thinking and higher level thinking skills in your classroom? List one or two specific activities and what either makes them successful, or how they could be improved to deep student learning.

Participate in online discussions
- What questions would you ask your students, as you look at the data and graphs from I Lost My Tooth, to encourage higher-order thinking skills and promote discussions? Create two questions and post them. Be sure to read and think about what your classmates have written. Do you think their questions encourage critical-thinking and discussion?

Complete activities and assignments
- Web-based Mathematics Assignment

Session 5: The Next Step

The learners will:

- Create a technology lesson plan incorporating teamwork, discussion, and critical thinking to teach math standards, and then teach and revise the lesson.
- Self-assess the lesson according to a rubric.
- Assess their learning in this course by comparing their prior knowledge and acquired knowledge.
- Analyze the learning experience in this course by reflecting about their professional goals and expectations.

Reflect in journal
- Reflect on their acquired knowledge:
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- Have you succeeded in learning about the areas you initially identified? Be specific.
- What is the most important information you learned in this course?
- What questions do you still have about fostering cooperative learning and critical thinking?
- What new knowledge and/or techniques did you learn that you could apply to your practice?
  - Reflect on their professional goals and expectations:
    - How does this learning experience compare with your goals and expectations?
    - Were there any professional goals you were unable to achieve? Why? How do you plan to address these areas of professional development in the future?

Participate in online discussions
- Post the critical-thinking questions you will ask your students in the lesson plan and solicit feedback from other learners. If possible, post a reply to at least 2 learners who teach at a similar grade level. Use the peer review guidelines for your response.

Complete activities and assignments:
- Final Project: Develop one technology-integrated lesson plan that addresses one topic in the math curriculum using teamwork, discussion, and critical thinking.
- Post-Course Evaluation Survey

Final Project

Learners will complete the final project as follows:

The lesson plan can incorporate pre-existing Web projects and curriculum software programs (such as the simulations described in Session 3.) The lesson plan should:

- Include the NCTM Communication Standard and math curriculum standards (NCTM or your district standards). The standards addressed by the lesson should be easily accomplished by your students and aligned with the technology used.
- Include clear and measurable objectives, a valid assessment, and a complete process. The overall objectives should be written in measurable terms, reflected in the lesson assessment, and clearly communicated to the students. The lesson procedure should provide a thorough explanation of the steps needed to accomplish the lesson and evaluate student understanding and mastery of concepts.
- Contain an assessment that matches the learning objectives; clearly addresses specific, measurable, and attainable goals; and allows for multiple learning styles.
- Address how you will implement cooperative groups and incorporate discussion and critical thinking. For instance, address the following questions for cooperative groups: What cooperative strategy will you implement? How many groups of students will you create? How will you create the groups? How will your classroom be arranged? How will you allow for multiple learning styles?
- Demonstrate use of resources from this course. For example, you might use a Web project from one of the recommended Web sites or a software program. Make sure that you include all Web site addresses and software information as well as any other resources your lesson plan incorporates. The description of your lesson plan should be created in a word processing program.
- Include critical thinking questions for your students.
- Include implementation: once you have created your lesson plan, implement it in your classroom.
- Include self-assessing your project using the lesson plan rubric. Write a 2-3 page paper based on your self-assessment, including the following information:
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- the pedagogical strategies you used in this lesson.
- a description of what went well and what you would change.
- the criteria you used to choose the technology you integrated into your lesson.
- capture student comments about their learning experience.
- observations you made about your students’ learning — from the students’ point of view, discuss what areas they were having difficulties with and what areas they found easier.

- Submit your lesson plan and reflection paper to the facilitator.

**Schedule**

This course is scheduled to take approximately 30 hours to complete readings, activities, video, assignments, reflections, and a final project. The number of hours identified for each course reflects time spent online, but does not reflect the total time spent completing offline coursework and assignments. All learners are different and learners will likely spend double the indicated number of hours completing all coursework depending on learning styles and work habits.

**Requirements**

Learners are expected to:

- Complete all assignments.
- Maintain an online journal.
- Participate and actively engage in discussions with fellow learners while contributing to the social construction of knowledge.
- Be self-directed and self-motivated.
- Ask for assistance when they need it.

**Materials (hardware, software, plug-ins)**

**Technical Requirements**

- Word processor
- Internet service provider
- E-mail

**Academic Dishonesty Policy**

To be inserted by university institution only

**Evaluation**

This course is evaluated on a letter grade basis, and may be available for graduate credit. See graduate credit details pertaining to specific graduate credit institutions.