Elementary Math Methods
Syllabus

Course Description

This course is designed to support both new and experienced elementary math educators in refining and focusing their instructional skills. Close examination of National Council of Teachers of Mathematics standards along with state and local requirements will serve as a springboard for designing and implementing developmentally appropriate math lessons using manipulatives, technology, problem solving strategies, and ongoing assessment to improve student learning.

Competencies

Upon completion of this course, participants will be able to
- Explain various theories of cognitive development and their implications for math instruction
- Design and implement lessons using both hands-on and virtual math manipulatives
- Evaluate and select virtual manipulatives that support mathematics teaching and learning
- Evaluate and support the appropriate use of calculators in the elementary math classroom
- Identify successful problem solving strategies and incorporate them into lessons targeting student needs
- Analyze student errors and provide needed remediation through differentiated instruction

Materials

All materials are accessed via the CaseNEX website using the PIN provided and the user name/password you create.

All readings listed can be found by going to Class Materials → Virtual Library → Readings (Search).

Temporary membership is available in the National Council of Teachers of Mathematics (NCTM). Principles and Standards are available for
reading on-line at http://standards.nctm.org/. **Sign up for the 90 day free access to the full document.**

If you do not have the most recent versions of the following software, please download each from the given sites.
- Windows Media Player
- RealPlayer
- Adobe Reader
- QuickTime

**Cases Used**
- Compare and Contrast
- On the Same Page
- What Do You Expect?
- What’s Happening

**Course Schedule**

Find session dates by selecting *Syllabus* on the top menu bar. For typical courses, final Discussions, Journals, and Workbooks are due by Saturday at midnight unless otherwise noted. Please see the News Flash for any alterations of the course schedule posted by your instructor.
**Introductory Session**  
*Exploring the CaseNEX Site*

Complete these tasks prior to the beginning of Session 1.

**Readings**

Read the course requirements, paying special attention to the Case-Analysis and Workbook Assignment Rubrics. They will be used by your instructor throughout the course to evaluate assignments where appropriate.

**Discussion**

Post one entry introducing yourself to your classmates. You may choose to describe your professional background and experience, relevant personal information, or why you are taking this course. (100 words or fewer)

**Journal**

What do you find inspiring and challenging about teaching mathematics? (100 words or fewer)

**Note**

Use CaseMail to send a note to your instructor stating that you will be taking this course. To do so, click on CaseMail on the top menu bar and then ‘Click here to create a new message.’ Use the marked link to look up an address. Continue linking down until you see the class list. Select the instructor’s name and then compose your message and hit ‘Post Message.’
Session 1
Understanding Learning Theory, Cognitive Development, and Math Instruction

Case
On the Same Page

Readings
- What Does Good Math Instruction Look Like?
- Piaget’s Key Ideas
- Applying Piaget’s Theory of Cognitive Development to Mathematics Instruction

Discussion
In the case On the Same Page, Elena Thurstrum is concerned about her daughter’s academic progress in her pre-school class. Draw upon knowledge gained from the readings and your own professional experience regarding cognitive development to analyze the math instruction presented in the case. Do you think Courtney is being challenged appropriately in math? Based upon the information presented in the case, do you think Courtney would be better served in the other school Elena visited? What additional knowledge might help you make a more informed recommendation? Describe additional actions you think her teacher could take to address her cognitive and developmental needs.

Journal
Apply knowledge gained from the readings to your own teaching situation and the developmental stages of your students. Describe any evidence you see in your classroom supporting or refuting these theories. How do these theories inform instructional decisions and plans in your classroom? Describe actions suggested by these theories that may help you better fit math instruction to your students’ needs.

Note
Check your CaseMail (linked from top menu bar) and News Flash (on the right when you login) for notes from your instructor every time you log on to the site.
Workbook

None this session
Session 2

Addressing Standards

Case
None this session

Readings
- NCTM Principles and Standards Trial Login (Log in, click on Chapter 3 and read the introduction to the Standards for School Mathematics.)
- Your state math standards
- Your school or district math curriculum

Discussion

Explore the perspectives of various students and their families. How do you think they would view the NCTM standards, state standards, and curriculum? How might their views compare to those of teachers and school administrators? Describe the actions and potential consequences suggested by this analysis, specifically focusing on ways educators may help families better understand connections between math standards, math instruction, and students’ developmental readiness.

Journal

Spend time comparing the NCTM standards, your state math standards, and your school or district math curriculum. Be sure to look at your grade level along with those that precede and follow it. In which ways are the NCTM standards reflected in the state standards and curriculum? Are there areas in which these are not aligned? Explore any issues that arise from your analysis. Then, select an area of focus for the Session 3 Unit Plan Workbook assignment. Describe the portion of your curriculum you have selected, the related state and NCTM standards, and a rationale for your choice.

Workbook

None this session
Session 3
Hands-On Manipulatives: Moving from Concrete to Abstract Thinking

Case
What Do You Expect

Readings
- Using Manipulatives
- Concrete-Representational-Abstract Instructional Approach
- 7 Musts for Using Manipulatives

Discussion

In the case What Do You Expect the class uses manipulatives to solve problems. Although most of the students were engaged in the activity, Eric clearly was not participating. Based upon knowledge gained from this session’s readings, suggest actions Mary Anne could take to engage Eric and better understand his place in the concrete-representational-abstract sequence. When you respond to your colleagues’ suggestions, take on the role of Eric or one of his classmates and explore what might be his/her perspective on the suggestions made.

Journal

Although the “Concrete-Representational-Abstract Instructional Approach” reading was written about students with learning disabilities, the instructional model it presents likely will be helpful to all students. Focus on the sequence it suggests (concrete, representational, and abstract) and a math skill or concept you will teach during this session. Propose actions you can take to help students move through the concrete-representational-abstract sequence. Experiment with these with your students, and reflect on their effectiveness. Include various students’ perspectives in your reflections.

Workbook

Unit Plan: Effective Use of Manipulatives

Focus on the lesson model presented in the “Concrete-Representational-Abstract Instructional Approach” reading and other
strategies presented in this session’s readings. Create a math mini-unit containing 3 lesson plans that you will teach in the next few weeks. Incorporate use of hands-on manipulatives and/or virtual manipulatives (covered in Session 4), and be sure to include the following information in each lesson plan:

- Description of classroom, students, grade level, and any other relevant information;
- Goals and objectives of unit and lessons, including NCTM and state standards where appropriate;
- Grouping of students;
- Materials, manipulatives, and/or virtual manipulatives;
- Management strategies for using the manipulatives;
- Procedures;
- Assessment of student understanding and use of manipulatives (informal or formal);
- Rationale for your choices, including knowledge from the readings and strategies for moving students through the concrete-representational-abstract sequence; and
- Reflections on at least one of these lessons following its implementation, including your successes and challenges using manipulatives

Due by the end of Session 5
Session 4
Using Virtual Manipulatives

Case
What Do You Expect

Readings
- Computing Technology for Math Excellence: Math Manipulatives
- Learning Mathematics with Virtual Manipulatives (use the reference section at the bottom to explore at least two topics of interest to you)

Additional Resource
- The National Library of Virtual Manipulatives
- Math Playground

Discussion

Based on knowledge gained from the readings, discuss the consequences of using virtual versus concrete manipulatives. In What Do You Expect, how might Mary Anne Brown use virtual manipulatives to engage all learners? What issues will Mary Anne have to address to incorporate the use of virtual manipulatives into her lesson and others like it? What might be the short- and long-term consequences of the actions proposed?

Journal

According to this session’s readings, what factors should teachers consider when selecting virtual manipulatives to support math instruction? Describe the issues that seem most pressing to you in evaluating virtual manipulative resources, such as those provided by the National Library of Virtual Manipulatives. Focusing on several different students with different math instructional needs, describe what might be their perspectives on these issues. In which ways does this analysis shape the actions you might take?

Workbook

None this session
Session 5
Using Calculators to Support Math Instruction

Case
What’s Happening (focus on scene 5)

Readings
- Computation, Calculators, and Common Sense: NCTM Position Statement
- Winning Equation: How Technology Can Help Save Math Education
- IT in Schools

Discussion
Discuss the pro and con perspectives on calculator use, including the perspectives of students. Use knowledge from the readings to support both positions and address issues related to calculator use in the elementary math classroom. How might Peter Flaherty in What’s Happening respond to the arguments made?

Journal
Explore the use of calculators with your math students through discussion and experimentation. Begin by gathering student predictions on how using calculators supports their math learning. Next, split your class into two groups, with one group using calculators and the other using other means for computation. Teach a lesson that incorporates computation, and allow each group to complete the lesson using their assigned tools. Have your students share their perspectives. Then, switch the groups for a similar lesson so that the students who did not use the calculators do so, and vice versa. Have students share their perspectives again. Describe any issues that arose for you and your students and your own reflections on this experiment, including thoughts on your formal or informal assessment of student learning.

Workbook
Unit Plan: Effective Use of Manipulatives due by the end of this session
Session 6
Solving Word Problems

Case
What’s Happening (focus on scene 5)

Readings
- Learning Math Through Problem Solving
- Math Problem-Solving: Combining Cognitive & Metacognitive Strategies
- Word Problem Solving Strategies
- Math Problem Solving Model

Discussion
The readings provide strategies that may be useful for all students learning how to approach word problems. Which of the suggestions from the readings do you think Peter Flaherty could use to support students’ problem solving skills in scene 5 of What’s Happening? What additional knowledge might he need to do so, and where might he find it? Describe what might be the intended, unintended, short- and long-term consequences of Peter employing the suggestions made.

Journal
The readings provide strategies that may be useful for all students. Describe some of the possible issues addressed in the readings that are also pertinent to your teaching situation. Implement at least one of the suggested strategies with your students this session. Reflect on your challenges and successes, and consider the perspectives of various students as you do so.

Workbook
Supporting Problem Solving

Focus on the “Math Problem Solving Model” reading and its various components. Select one of the following assignments for development and use in your classroom. (Note: This assignment will be the basis of next session’s discussion; work in MS Word and attach your document in your Workbook for instructor feedback this session. You will attach the same document in the Discussion area in Session 7 for use by your online colleagues).
Adapt the scoring grid found under the Scoring Students Work section for use with your class. Your grid should be written in student-friendly language that matches your students’ reading levels and should be general enough to be useful for assessing problem solving throughout your math program. Introduce this tool to your students and reflect on their feedback about its usefulness. Make any needed revisions. Reflect on this process, describe how you will use this grid with your students, and attach the grid to your Workbook. (Recommendation: create your grid in MS Word).

OR

Explore the Teaching Strategies section, and focus on the high quality problems link. Review the criteria presented here, and use it to evaluate a set of math word problems included in your math program (math text, support materials, or teacher created materials). Revise the set of problems so that it provides a strong match to the criteria listed, or develop a new set of math problems that do so (be sure to match your students’ reading levels). Provide 10 or more high quality math problems appropriate for your students. Use these in a lesson with students and reflect on your experience. How will you fine-tune these for future use? Be sure to reflect on each step of this process and attach or list the math problems in your Workbook.

OR

Review the bulleted list of problem solving strategies included in the Teaching Strategies section under the high quality problems link. Select a set (4-8) word problems which may be solved using several different strategies. Design 2 lessons for your students in which you model using different strategies to solve the same problem. Your lessons should include time for students to practice and demonstrate use of the various problem solving strategies. Ask students to reflect on their experiences, and modify your lessons for future use based upon their feedback. Be sure to reflect on each step of this process and use the lesson plan model from the Session 3 Workbook assignment.

Due by the end of this session

Session 7
Organizing Information

Case
None this session

Readings

- Students Use Graphic Organizers to Improve Mathematical Problem-Solving Communications
- Graphic Organizers

Discussion

Attach your Session 6 Workbook assignment for others to review (list your grade level and the assignment type under the “description” for easy reference). Then, read those posted by your online colleagues, and select one that is suited to your own classroom needs. Make any needed modifications and use this with students this session. Share your experience.

OR

Post the most effective graphic organizer (GO) you used with your students from this session’s journal. Consider your colleagues’ graphic organizers using the three criteria (coherence, consistency, and creativity) presented in this session’s reading, and suggest actions they might take to address student needs through the use of this GO. How might this GO be used as both a teacher-directed and student-directed tool for organizing concepts, presenting problem-solving methods, or building vocabulary? Consider a range (regular education, LD, gifted, etc.) of student perspectives on the use of this tool.

Journal

Draw upon knowledge you have gained from the reading and your professional experience to brainstorm various ways the use of graphic organizers may support problem solving in your math class. Experiment with at least two graphic organizers in your math class sometime this session and reflect on your results. Describe the steps that should be used when using graphic organizers with students. What actions might you take to strengthen your use of these tools next time you use them?
Workbook

None this session
Session 8
Using Error Analysis to Differentiate Math Instruction

Case
Compare and Contrast

Readings
- Differentiated Learning
- Differentiated Instruction and Implications for UDL Implementation
- Assessment Strategies

Discussion

In Compare and Contrast, Huck and Billie group students based on their performance on the Math Standards Pre-test, observations, and socio-emotional considerations. Using knowledge from the readings, suggest placements for Helen and Ben. What issues are raised by the teachers’ assessment methods, and how might you remedy them?

Journal

Collect computation samples from two or more students you know who are struggling in this area. Use the “Error Pattern Analysis” section of the “Assessment Strategies” reading to analyze the students’ math errors. Describe the error patterns you see, and propose three or more actions their teacher could take to differentiate instruction to meet their needs. Draw upon knowledge gained from the readings to substantiate your ideas. What might be the consequences, both intended and unintended, of the actions you have proposed?

Workbook

Authentic Case Analysis

Use the 5-Step Case-Analysis Method to reflect upon a situation in your school related to math instruction. Describe the situation in one or two paragraphs. Address each of the 5-Steps in turn, referring to the Course Tutorial and the Case-Analysis Rubric to guide your thinking. Draw upon the methods, concepts, and ideas presented in this course throughout your analysis.

Due by the end of this session