MAE 4326: How Children Learn Mathematics
Section 0003: Wednesdays, 1:30 p.m.–4:20 p.m. TA 204, Fall 2012

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Office Hours: Tuesdays, 4:00 pm–6:00 pm; Wednesdays, 4:20 pm–6:20 pm; & Thursdays, 2:30 pm–3:30 pm

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Description: This course includes instructional strategies, learning activities, and the use of manipulatives, lesson planning, evaluation of mathematical learning and diagnostic techniques. Prerequisites: MAE 2801 or consent of instructor and admission to Phase II. (3 semester hours)

Course Goals: The facilitating reflective practitioner will:
1. Develop knowledge of how children acquire mathematics understanding and skills;
2. Develop skills in the selection and use of materials and methods appropriate for teaching mathematics to elementary school children.

Key: FEAP/PEC = Florida Educator Accomplished Practices and Professional Education Competencies
ESOL = English for Speakers of Other Languages
FSA = Florida Subject Area Competencies (Elementary Education)
NCTM = National Council of Teachers of Mathematics Standards

The facilitating reflective practitioner will:
1. Utilize the scope and sequence of the elementary mathematics curriculum as outlined in the Sunshine State Standards and the National Council of Teachers of Mathematics to develop instruction, including their links and applications to other disciplines (FEAP/PEC 8; NCTM 1-10);
2. Demonstrate proficiency in elementary mathematics in order to assess and help meet the needs of students at various levels of ability FEAP/PEC 1, 5; FSA 1.4; NCTM 1-10);
3. Prepare and teach mathematics lessons which provide for students’ input into the learning process, actively involve students’ critical thinking, and are based and focused on the elementary school student (FEAP/PEC1-12; PEC 14; FSA 1.3; ESOL 6, 7, 11, 12, 14, 15, 16);
4. Describe and discuss classroom management as it relates to the teaching of mathematics lessons (FEAP/PEC 8, 9, 10); ESOL 12, 14, 19;
5. Identify and apply specific techniques and motivational ideas (including the arts) available for teaching specific topics in the elementary school mathematics curriculum (FEAP/PEC 7, 8, 9; ESOL 6, 7);
6. Differentiates instruction by selecting and using materials that are appropriate for teaching specific mathematics topics to children at varying developmental levels (FEAP/PEC 5, 8, 10 12, PEC 14; FSA 6.2; ESOL 15);
7. Discuss the effects of cultural diversity (including differences such as sex bias) on mathematical learning (FEAP/PEC 5, 6; ESOL 3);
8. Describe and implement ways in which the mathematical instructional needs of the exceptional learner can be met in the elementary classroom (FEAP/PEC 5, 7, 9; PEC 14; ESOL 12, 16);
9. Demonstrate a positive, self-reflective, and professional attitude toward the life-long process of teaching and learning mathematics (FEAP/PEC 3, 6, 11);
10. Demonstrate an understanding of the use of technology, calculators, and computers in pursuing mathematical investigations (FEAP/PEC 12); and
11. Demonstrate knowledge of specific educational needs, language development, and approaches, methods, and strategies appropriate for students with limited English proficiency in the area of mathematics (FEAP/PEC 5, 7, 9; PEC 14; ESOL 11).
Mode of Instruction:
This course combines lecture/lab/discussion/online formats. Emphasis is placed on hands-on, manipulative-based activities and reflective thinking.

General Procedures/Requirements:
Required textbook:


Other Required Readings: Young, S.L. (1985). The diagnostic-prescriptive teaching of mathematics. Mimeographed. (This document will be available through the Bookstore.)

Methods Lab Kit (EAI Education): This kit will be given in class containing: Overhead Geoboard (5 x 5 peg grid) with rubber bands, Pattern Blocks, color tiles, Fraction Dice, GeoModel Solids, and Two-color counters.

Disabilities: Students with disabilities who require modifications to complete assignments successfully are encouraged to meet with the professor as early as possible in the semester to identify and plan specific accommodations. Students may be asked to supply a letter from the Office of Student Disability Services.

Golden Rule (http://www.goldenrule.sdes.ucf.edu): According to UCF’s Golden Rule, academic dishonesty, (including plagiarism; misrepresentation of work completed; use of work completed by students in previous sections of the class, etc.) is a violation of student academic behavior standards and is subject to academic and/or disciplinary action. Within the College of Education, violations of this nature may also result in fitness-to-teach evaluations. All papers will be subject to submission to www.turnitin.com

UCF College of Education Code of Professional Conduct (www.education.ucf.edu/docs/accreditation/CEDCodeofProfessionalConduct.pdf): Read and familiarize yourself with this document. The College of Education at the University of Central Florida expects current and future educators to possess and exhibit professional dispositions deemed essential to success as a professional educator. These are reflected in the unit’s Conceptual Framework and National Council for Accreditation of Teacher Education (NCATE) unit standards. Assessment of these professional dispositions is integrated into key formative and summative standards-based performance assessments in initial and advanced educator preparation programs in the unit. Guidelines for documenting and remediating concerns regarding a candidate’s professional dispositions are provided at Attachment 1.

Attendance and tardiness: Class attendance and participation are critical for your learning experience in this class and will be considered in the course grade. If you will be absent or late, you must notify the Professor BEFORE the beginning of the class session. Every absence will result in a 10-point deduction from your total points. Every unexcused tardiness or incidence of leaving early will result in a deduction of 5 points. [Course Objectives: 9]

Make-up Exam Policy: No one will be excused from exams unless it is an emergency situation. Upon presentation of appropriate documentation, missed exams may be taken within one week of the originally scheduled examinations.

Assignments: Unless previous arrangements have been made with the Professor, late assignments will not be accepted. An assignment that does not follow guidelines given in class will not be accepted. If a resubmission is allowed, up to 20% of the total points will be deducted. Unexcused late assignments will receive 10% grade reduction per every 24-hour period. Assignments will not be accepted after one week following the due date.

E-mail Communication: We will use Knights E-mail to communicate. The College of Graduate Studies has developed a new web page. This page is meant to be a guide to help students receive their Knights E-mail on their smart phones and to have other email clients bring in the Knights E-mail to existing email accounts. While forwarding is not possible from Knights E-mail, it is possible to have the Knights E-mail "pop" into other email accounts. http://www.students.graduate.ucf.edu/knights_email/
Course Requirements:
You will receive additional information and/or grading rubrics for each assignment during the semester. Readings and other activities will also be required throughout the semester. It is expected that you will create evidences of meeting accomplished practices for your Professional Portfolio entries through completion of two of these assignments. Please see http://reach.ucf.edu/~ed_found/ for portfolio guidelines.

All assignments will be submitted electronically through the Assignments Tool in WebCourses@UCF. All files should be titled ASSIGNMENT_LASTNAME (.doc, .docx or .pdf, etc). Please attach files – do not copy and paste into the submission box.

IMAP Videos used in these activities were created during IMAP project by Randolph Philipp, Bonnie Schappelle and Candace Cabral.

A. Academic Requirements:
1. Reading/Viewing Reflections (Part a) and Field Experience Entries (Part b): (4 @ 25 points each, 100 total points): Each student will complete five Reading/Viewing Reflections and Field Experience Entries during the semester (each with one-inch margins, 12 point Arial or Times, and at least 3 pages long single-space all together, including parts a and b, but without the description of the tasks. You just need to use the number identifying the task).

<table>
<thead>
<tr>
<th>Rubric for Each Reading Reflection</th>
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<tr>
<td><strong>4.5 - 5 points:</strong> Provided evidence of reading and/or viewing materials, and included examples from and connections to other readings, UCF class, field experiences, personal and/or professional experiences. Supported responses and ended with at least one question you still have. Included I statements to express ideas. Answered all questions, and followed guidelines.</td>
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<tr>
<td><strong>3.5 - 4 points:</strong> Provided some evidence of reading and/or viewing materials, but did not include sufficient examples or questions. Did not include at least one question you still have, and followed guidelines.</td>
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<td><strong>0 - 3 points:</strong> Provided little evidence of reading and/or viewing materials, or did not include examples, connections or questions, or it is clear the reading was not read or sufficiently analyzed.</td>
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Reading/Viewing Reflection and Field Experience I:
a. Reading/Viewing Reflection 1:
Do activity 1 and select two (2) of the other activities (5 points each);

1) Write a reflection for the following reading: Number & Operations: Session 10: Classroom Case Studies: Choose a grade band:


3) Watch one of the video reflections and answer the discussion questions for this video: Illuminations: Understanding a Child’s Development of Number Sense:

4) Which theory was prevalent when you were learning elementary math? In what ways can you encourage your students to construct meaning? What can you do to prevent math phobia? How might a concept web help you plan an action research project?

5) Choose three different problems from your classroom and solve them. Show your work and describe the solution strategies you used.

6) Imagine that you are an elementary school teacher and one of the children expresses frustration about solving problems, asking you to “just tell me how to do it.” How will you respond?

7) Describe how you would establish a classroom environment conducive to problem solving.

8) Video 3. Place Value Video 3. Place Value:
(http://www.learner.org/resources/series171.html?pop=yes&pid=1846#): Summarize and reflect
on the information presented here.

9) Planning and Teaching Mathematics: Assignment and Activities: Factors That Influence the Teaching of Mathematics:

**Introduction:** You will view a lesson in a classroom in which a teacher is using manipulatives to teach students concepts related to fractions. Notice some of the factors that influence the teaching of mathematics.

**Manipulative Strategies**

a) What factors did you notice that might influence the teaching of mathematics in this lesson?
b) How does the teacher feel about the importance of using manipulatives in math?

10) Topics: Planning & Teaching Mathematics: Assignment & Activities: Identifying Current Directions in Teaching Mathematics:

**Introduction:** In this activity, you will watch two short video clips. [In the first clip, Real-World Math Method, focus on the end of the clip starting at the 2:30 mark.] As you view the clips, notice the important points that the teachers are making about how to teach mathematics. They are noting some of the current directions in the teaching of mathematics, and they are explaining why these recommendations are important.

**Clip One: Real-World Math Method**
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=MMET_001_238.flv

**Clip Two: Using Manipulatives as Models**

a) List at least three or four important points that the teachers in the videos made about how to teach mathematics effectively.
b) How would you summarize some of the current directions in teaching mathematics?

11) Topics: Influence of Standards in Teaching of Mathematics:
The National Council of Teachers of Mathematics (NCTM) has developed documents to outline factors that this professional organization considers important for the development of national, state, and local policies related to the mathematics curriculum. Go to the NCTM site to access a document entitled “Guiding Principles for Mathematics Curriculum and Assessment.” Scan this document for important guidelines. Compare the guidelines in this document to some of the major ideas that you have already developed while exploring this topic related to the planning and teaching of mathematics. *What important ideas did you find in the NCTM document related to classroom practices that you can identify in each of the classroom video examples?*

**Weblink:** Guiding Principles for Mathematics Curriculum and Assessment
http://www.nctm.org/standards/content.aspx?id=23273

**Video:**
Manipulative Strategies

Real-World Math Method
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=MMET_001_238.flv

Using Manipulatives as Models

12) Topic: IMAP - Learning Mathematics

**Introduction:** Educators generally believe that students should develop both understanding of mathematical concepts and facility with mathematical procedures. In this activity, you will be asked to consider the importance of both of these and the order in which they should be taught.

**IMAP - Learning Mathematics**

a. In this video clip, Rachel is interviewed at two different times (five weeks apart) during her
learning about improper fractions. Describe the difference between procedural knowledge and conceptual knowledge based on the examples shown.

b. What representation modes did Rachel use during each of these interviews.

c. What are the implications for teaching procedures before concepts?

13) Topics: Children's Mathematical Thinking: Assignment and Activities: IMAP - Modes of Representing a Mathematical Concept:

Introduction: One way to help children develop deep conceptual understanding is to carefully select the modes of representation you and they use in doing mathematics. The five modes are real-world situations, manipulative (hands-on) models, pictures, oral language and written symbols. The purpose of this activity is to identify and provide examples of the different modes of representation in understanding how children may think.

IMAP - Making Sense of Solutions
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Grade_1_Class_17.flv

a) As you view the video clip, name and describe each mode of representation that arises and state how each one helps children understand the mathematics of the problem.

b) Describe another approach to help children understand the math of the problem.

14) Topics: Children's Mathematical Thinking: Assignment and Activities: IMAP - Communication in the Mathematics Classroom:

Introduction: Communication in mathematics learning makes children think through a concept and can help children clarify what they do or do not understand. Communication can take many forms. It can be oral or written. It can be between and among children or between the teacher and the children. The purpose of this activity is to illuminate the importance of communication in assessing children's mathematical thinking as concepts are being developed.

IMAP - Fraction Misconceptions

a) This question deals with oral communication. Watch the first part of the video clip where Ally, a fifth-grader, is asked to circle the bigger of two fractions in sets of five pairs and then to write equivalent improper fractions and mixed fractions. The interviewer asks her to explain how she was thinking about each item. What does this oral form of questioning tell you that Ally’s written work did not tell?

b) Watch the second part of the video clip where the interviewer speaks with Ally’s teacher. Do you agree or disagree with Ally’s teacher that Ally is aware of what she does not understand? Use the first part of the video clip to support your answer.

c) From the video interview, what mode(s) of representation does Ally’s teacher use during her instruction and what mode(s) of representation does Ally use?

15) Topics: Children’s Mathematical Thinking: Assignment and Activities:

Introduction: When using the constructivist approach to teaching number concepts, the teacher usually provides manipulatives or other tools for students to use to help them discover the mathematical concept. The goal is for the student to figure out how to solve the problem, thus constructing the knowledge in his/her brain. When using the behaviorist approach, the teacher usually shows the students a procedure to use to solve the mathematical problem. The student is expected to memorize the procedure and to use it to solve problems when appropriate. In this clip, note how Gretchen, a second-grade student, approaches finding the solution to 70 minus 23.

IMAP - Gretchen
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Gretchen_2ndGrade_03.flv

a) Gretchen’s answers indicate that she has been taught using both constructivist and behaviorist methods. In the video, she demonstrates three methods for solving the problem 70 minus 23. Explain which approaches reflect the constructivist and which reflect the behaviorist approaches. Justify your explanations.

b) Based on Gretchen’s insistence that “53” was correct and that the answer “47” was not correct, what might you conclude about which approach she considered to be more important? Why do you think children value this type of strategy?

c) How might teachers help students to see the value of constructing conceptual knowledge?
16) Topics: Problem Solving: Assignment and Activities: Math Strategies for Problem Solving:

**Introduction:** In this activity, you will see examples of authentic problem solving and look for ways that the examples tie into the NCTM Problem-Solving standard and expectations. In addition, you will consider the different categories of problems and link these to the examples in the video clip

- process problems in which non-computational processing is required;
- translation problems, which are vehicles to deepen children’s understanding of computational processes;
- application problems, which enhance students’ appreciation of mathematics in real-life processes; and
- puzzles, which require unusual solution approaches.

Math Strategies for Problem Solving
[Link](http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=MMET_003_294.flv)

a) In the clip, a 5th-grade class investigates the average height of a 5th grader. In what ways does the activity constitute problem solving?

b) Into which category or categories do the two activities, “Thirteen” and “Average Height,” fit? Explain your reasoning. How does each activity qualify as problem solving rather than practice exercises?

17) Topics: Problem Solving: Assignments and Activities: Problem-Solving Strategies:

**Introduction:** There are several different problem-solving strategies, namely, model or dramatize, draw a picture, construct a chart or table, find a pattern, solve a simpler problem, guess and check, work backward, consider all possibilities, use logical reasoning, or, change your point of view. In this activity, you will examine several of these and connect them to the different problem-solving categories:

- process problems in which non-computational processing is required;
- translation problems, which are vehicles to deepen children’s understanding of computational processes;
- application problems, which enhance students’ appreciation of mathematics in real-life processes; and
- puzzles, which require unusual solution approaches.

Clip 1: Food Survey Lesson
[Link](http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathematicsmethods&clipID=MM05_141.flv)

Clip 2: Math Strategies for Problem Solving
[Link](http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=MMET_003_294.flv)

a) In the first video clip, the teacher uses a real-world problem to examine the mathematics in a food survey of her first-grade students. Which of the problem-solving strategies listed in this activity’s introduction are evident in this lesson? Justify your answers.

b) How does the teacher use the data set to extend the lesson? What problem-solving strategies are used in the extension?

c) Which categories (process, translation, application, or puzzle) are reflected in this lesson?

18) Topics: Problem Solving: Assignment and Activities: Why problem-solving is important in mathematics instruction:

**Introduction:** In this activity, you will view two clips in which a teacher discusses how she helps develop students’ problem-solving skills. Both clips encourage you to consider the importance of using rich problem situations in mathematics instruction.

Part 1: Strategies for Solving Math Problems Part 1

Part 2: Strategies for Solving Math Problems Part 2
a) What experiences and growth do children experience through good problem-solving experiences?

b) In planning for this problem-solving activity, the teacher prepared a package of materials that her students may choose to use. What problem-solving strategies did she consider her students might use? Explain your thinking.

c) What is the teacher’s rationale for offering different opportunities to solve problems?

19) Topics: Problem Solving: Assignment and Activities:

Introduction: A fifth-grade class has been studying about perimeter and area. Their teacher is involving them in an authentic application of these mathematical concepts. After a quick review of the definitions of perimeter and area, the students are asked to calculate the area of carpet needed to cover an irregular portion of their rectangular classroom. Groups of students go to work collecting measurements and determining problem-solving strategies. As you listen to the students’ discussion, consider what concepts they seem to have mastered and which ones they still hold misconceptions about. The groups arrived at many different answers to the problem. The teacher needs to decide what to do next to ensure her students can effectively solve this type of problem.

Finding Area
http://abavtooldev.pearsoncmg.com/myeducationlab/simpleviewer.php?projectID=mathematicsmethods&clipID=MM_06_147.flv

a) What are the five steps in the problem-solving model shown in this video clip?

b) List two real-world examples of the concepts of perimeter and area.

c) Describe or illustrate two problem-solving strategies for determining the amount of carpet needed to cover an irregular area within a rectangular room.

d) One of the student groups said they multiplied the perimeter to find the area. Why did this approach not give them the correct answer?

e) As the teacher, what would you do to help these students determine an effective problem-solving strategy for this type of problem?

20) Review and reflect on the following documents: The Marzano Center (http://www.marzanocenter.com) web site has published a report that is worth examining. It purports to show that use of the Marzano framework has been shown to produce student learning gains. The report can be found at: http://www.marzanocenter.com/Teacher-Evaluation/MC-whitepaper/?utm_source=Listrak&utm_medium=Email&utm_term=http%3a%2f%2fwww.marzanocenter.com%2fTeacher-Evaluation%2fMC-whitepaper%2f&utm_campaign=New+Marzano+Center+White+Paper+Offers+Detailed+Evidence+of+Student+Learning+Gains

b. Field experience 1 (10 points): Select two (2) of the following activities:

1) Assume that you need to report back to your grade-level team or to the entire school staff at a faculty meeting on your experiences and learning in this course. What are the main messages about the teaching of number and operations that you would share with your colleagues? Prepare a one-page handout or an overhead or slide that could be distributed or shown at the meeting.

2) Look at a lesson or activity in your own mathematics program for your grade level that you think has potential for developing students’ reasoning about number and operations. You were to use this lesson or activity now, after taking this course, how might you modify or extend it to bring out more of the important ideas about number and operations? You may use activities or lessons from your field experiences that you have taught or use for tutoring purposes.

3) Reflect on one classroom and/or school cultural diversity, technology facilities, manipulatives and other instructional resources available to the teachers as it relates to the teaching of mathematics (including assessment; developing number concepts; and developing understanding of numeration). How does the teacher assess children’s mathematics understanding and achievement? Describe the type of assessments used by the teacher (you could interview the teacher and ask for sample of the students’ written work). How would you assess the children’s understanding based on their written work? If available, how does the teacher employ performance tasks or portfolios in assessing the children? How were the levels of learning (concrete, representational and abstract) used by you or the cooperating teacher (give examples)?
4) Informally interview one (or more) student in your internship and assess his/her understanding of
number or operations (based on his/her grade level). Describe assessment and the student’s
understanding.

5) Identify a math concept appropriate from your grade level during your field experiences. How was
it presented or how can you present at the concrete level for that concept to your students? List a
model for each of the modes of representation.

6) Review and reflect on
   • the teacher’s edition or student’s edition being used for one grade level mathematics textbook
     (for example, from the Silver-Burdett Publishing Company),
   • the Next Generation Sunshine State Standards for mathematics and your grade level (talk with
     your cooperating teacher or the school librarian, or visit the following Website:
     http://www.floridastandards.org/Standards/FLStandardSearch.aspx; and/or
   • Common Core State Standards Website: http://www.corestandards.org/the-standards/mathematics;
   • any other curriculum materials available to the teacher (you may use interviews of the
teachers, parents or administrators, and/or observations).

When reviewing these curriculum materials, think about how they implement the ideas discussed
in this course so far, including an explanation of how the levels of learning (concrete,
representational and abstract) were used in the field experiences by you or the cooperating teacher
and give examples.

7) During your field experiences, observe the solution strategies used by children. Describe these
activities (include grade level and procedures) and the follow up lessons or activities you might
plan if you were the teacher in that classroom.

Reading/Viewing Reflection and Field Experience II:
a. Reading/Viewing Reflection 2: Do activity 1 and select two (2) of the other activities (5 points
each):

1) Write a reflection for the following reading: Patterns, Functions, & Algebra: Session 10:
   Classroom Case Studies: Choose a grade band:
   http://www.learner.org/courses/learningmath/algebra/index.html

2) Watch one of the video reflections and answer the discussion questions for this video:
   Illuminations: Teaching, Learning and Communicating about Fractions:
   http://illuminations.nctm.org/Reflections_3-5.html.

3) Read this session and Watch: Video 4. Meanings and Models for Operations:
   http://www.learner.org/courses/learningmath/number/session4/index.html. Then complete
   Homework for this session.

4) How will you gather evidence that shows your students are learning? In what ways could you
   adapt rubrics from this chapter for your classroom? Why is it important to use a variety of
   assessment tools?

5) Visit and evaluate two (2) the following websites. Write a short description and evaluation:
   Assessment Resources (http://www.score.k12.ca.us/ppt/sld006.htm), Balanced Assessment in
   Mathematics (http://balancedassessment.concord.org/), Assessment in Mathematics Teaching

6) Visit and evaluate the following NCTM websites. Write a short description and evaluation:
   NCTM (http://www.nctm.org), Illuminations (http://illuminations.nctm.org/) and Elementary
   School Resources (http://www.nctm.org/resources/elementary.aspx).

7) Visit and evaluate the following websites. Write a short description and evaluation: Teach Me 1,
   2, 3’s (http://funschool.kaboose.com/formula-fusion/games/game_teach_me_1-2-3s.html), and
   Number Matching

8) What advice would you give to the parent of a preschooler about how to develop a foundation for
   understanding numbers? What can you do to ensure students are counting rationally? How can
   you develop students’ understanding of number relationships?

9) How will you make the transition from concrete to pictorial to symbolic as you help your students
develop an understanding of place value? What number approximation skills are appropriate for
the grade level you teach? How can you help your students develop an understanding of large numbers? Which of the children's trade books this chapter describes might you use to help students understand numeration? What estimating activities are appropriate for your grade level?

10) Topics: Assessment: Assignment and Activities: Types of Assessment and Their Purposes:

**Introduction:** In this activity, using the NCTM Assessment Principle excerpt provided, you will view a pre-lesson interview with a sixth-grade mathematics teacher about the various ways she assesses her students’ mathematical understanding.

**Assessing Student Understanding**

http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectId=mathmethods&clipID=Assessing_Student_Understanding.flv

a) Discuss at least four answers the teacher offers in response to the question, “How are you going to know the students are getting it?”

b) The NCTM Assessment Standards identify four purposes for assessment:
   - Monitoring children’s progress toward learning goals;
   - Making instructional decisions to modify instruction to better meet children’s needs to increase learning;
   - Evaluating children’s achievement, which serves to inform parents and ensure that milestones are attained; and
   - Evaluating programs as a whole to ensure that all children are making progress.
   For each of the ways that you listed in Question 1, which purpose did the particular assessment serve?

11) Topics: Assessment: Assignment and Activities: Performance Assessment in Action:

**Introduction:** In this activity, you will view a video clip of the sixth-grade teacher interacting with a small group and with an individual student. In this lesson, students are solving rectangular area problems with fractional side lengths. The goal is for them to “invent” the multiplication of fractions algorithm using diagrams. Consider her approaches to finding out what students understand about the area problem they are investigating.

**Assessing Individual Performance**


a) How does the teacher assess the students’ understanding in the group? Why does she continue to ask questions?

b) When the individual student asks her to validate his answer, how does she assess his understanding beyond the algorithm he has written on his paper?

c) The teacher asks many questions instead of simply telling her students about the mathematics. What instructional and assessment purposes does questioning serve?

d) Consider the purposes for assessment:
   - Monitoring children’s progress toward learning goals;
   - Making instructional decisions to modify instruction to better meet children’s needs to increase learning;
   - Evaluating children’s achievement, which serves to inform parents and ensure that milestones are attained; and,
   - Evaluating programs as a whole to ensure that all children are making progress.
   What purpose(s) do the teacher’s questions to her students serve?

12) Topics: Assessment: Assignment and Activities: IMAP – Assessing Student Understanding:

**Introduction:** Interviewing children about their mathematical reasoning in problem solving is a powerful way to gain insight into how students think. It is important to probe a child’s thinking while also maintaining a comfortable environment for the child. In this activity, you will view two videos about setting the stage for a performance interview with a young child. In the first clip, a prospective elementary school teacher begins an interview with Stephanie, a first-grade girl. In the second clip, an interviewer with much more experience in interviewing children, speaks with Nicole, a second-grade girl. Watch both clips before answering questions, and look for similarities and differences in their interviewing styles.

**IMAP – Stephanie**

http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectId=mathmethods&clipID=IMAP_Stephanie_20.flv
IMAP – Nicole

13) Topics: Assessment: Assignment and Activities:
   **Introduction:** In this activity, you will observe a performance assessment in which the interviewer seeks to follow the child’s thinking process rather than accepting her direct answer to a particular problem.
   IMAP - Using Mathematical Reasoning
   a) Three times Nicole gives the incorrect answer to the problem posed by the interviewer. How does he assess her understanding of this type of problem?
   b) When Nicole uses the blocks to solve the problem she arrives at the incorrect answer. From a performance perspective, does Nicole understand how to solve the problem?
   c) Describe how a performance assessment provides more information about a student’s mathematical thinking than a right or wrong answer on a written assessment.

14) Topics: Assessment: Assignment and Activities:
   **Introduction:** This activity focuses on the purposes of assessment and the relationship between assessment and curriculum.
   Authentic Assessment
   a) How does assessment help guide the teacher's lessons? What is the relationship between curriculum and assessment?
   b) When assessing math skills, what three things are we looking at?
   c) What is authentic assessment, and what role does it play in the overall assessment of a student's academic performance?
   d) What are the advantages of authentic assessment over standardized testing, and vice versa?

15) Topics: Assessment: Assignment & Activities: Using a Rubric:
   **Introduction:** In this activity, you will observe how a teacher uses rubrics to help students develop the ability to assess themselves by assessing peer work and reflecting on their own work and performance.
   Using Standards to Focus Students Performance Assessing Learning Part 3
   a) Describe the two rubric assessments viewed in this video clip.
   b) Why is peer- and self-assessment important for young learners? How does the teacher ensure that each student will be assessed fairly by a peer?

16) Topics: Number Concepts and Operations:
   Assignment and Activities: Skip Counting: Introducing Skip Counting:
   **Introduction:** In this video, you see a teacher leading students in skip counting. Pay attention to the number concepts that the students seem to be constructing as they participate in this activity.
   Introducing Skip Counting
   a) In what type of counting activity was the teacher leading the students? What particular concept was she trying to get the students to notice that is required for this type of counting?
   b) What kinds of mathematical concepts do you think children might learn to construct on the foundation that they are building as they learn this skill?

17) Topics: Number Concepts and Operations: Assignment & Activities: Number Relationships Involved in Counting:
   **Introduction:** One very important and basic number relationship for students to understand is the concept of counting. While this appears on the surface to be a very simple, basic relationship, an
exploration of this concept reveals that there are several important relationships that are required to understand the concept of counting. This video clip, taken from a professional development session for teachers, will help you to discover what those number relationships are.

Number Relationships
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=Number_Relationships.flv

a) Counting is a more complex concept than most people realize. What are the number relationships that are involved in the concept of counting?
b) It is not likely that anyone taught you these specific concepts or pointed out these particular number relationships to you, so how do you think that most people learn these number relationships?
c) Why should the teacher be aware of these number relationships that are inherent to the concept of counting?

18) Topics: Number Concepts and Operations: Assignment and Activities: Representation of Numbers: Representation of Numbers:
In this clip of a professional development session, the workshop leader solicits many different ways to represent numbers.

Representation of Numbers

a) What are some of the various ways that the workshop participant identified as ways to represent numbers?
b) Why should teachers be aware of the fact that there are many different ways to represent numbers?

19) Topics: Number Concepts & Operations: Assignment & Activities: IMAP-Problem Solving in Grade 2:
In this clip, a teacher poses the following problem to second-grade students, “There are 25 children at the beach. Each child has 10 sand toys. How many sand toys are there?” Note how the students build concepts of place value as they use blocks to solve the problem.

IMAP - Problem Solving in Grade 2
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Grade_2_18.flv

a) How are students learning about place value as they learn to trade 10 sets of 10-blocks for one set of 100 blocks?
b) The blocks the students are using are called place-value blocks. Explain why these materials represent a proportional base-ten model?
c) Would a set of coins be considered a proportional base-ten model?
d) Early in the exercise, the teacher asks each child to solve the problem in two ways & then explain each method. Why does the teacher require the student to solve the problem in two ways?

20) Topics: Number Concepts and Operations: Assignment and Activities: IMAP – Understanding Place Value:
Introduction: In this clip, a young girl responds to questions and demonstrates her understanding of basic place value.

IMAP - Zenaida

a) How does Zenaida show that she understands the concept of place value?
b) How might a teacher help children who do not see that there are 12 tens in 120, but who are ready to make sense of this idea?

21) Topics: Number Concepts and Operations: Assignment and Activities: IMAP – Complexities of Place Value:
Introduction: In this clip, two prospective elementary teachers work with a young girl to check her understanding of place value. Notice how the use of place-value blocks helps the young girl to develop some complex ideas of place-value concepts.

IMAP – Talecia
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Talecia_07.flv
a) What problem does Talecia have in this clip?
b) How does Talecia use place-value blocks to figure out how to solve the problem 638 plus 476?
c) Why do you think she was more successful when she used the blocks than when she tried to follow a procedure without using blocks? How can you tell that Talecia is beginning to understand the concept of place value?

22) Topics: Number Concepts and Operations: Assignment and Activities:
   Introduction: A student explains his thinking that 19,200 times 10 equals 192,000.
   IMAP - Grades 3-4 Reasoning
   a) How does Donnie show a complex understanding of place value?
b) What can you conclude about Donnie’s thinking process?

b. Field experience 2 (10 points): Select two (2) of the following activities:
   1) Interview a teacher in the grade level above you. Pick one of the problems in your internship textbook, and ask them the following: How does the content of this problem prepare students for algebraic thinking in their grade? Why do they think this content is important? How could this problem be extended for students in their grade?
   2) Look at a problem in your own mathematics program for your grade level that you think illustrates patterns, functions, or algebraic thinking. Describe the problem. If you were to teach this problem after taking this course (you can also based on your tutoring and/or teaching experiences within your internship), how might you modify or extend it to bring out more of the content of patterns, functions, or algebraic thinking?
   3) Based on patterns, functions, and/or algebra, review and reflect on the teacher’s edition or student’s edition being used for one grade level mathematics textbook (for example, from the Silver-Burdett Publishing Company), the New Generation Sunshine State Standards (NG-SSS) for your grade level (talk with your cooperating teacher or the school librarian, or visit the following Web site: http://www.fldoestem.org/page221.aspx for downloads or http://www.floridastandards.org/Standards/FLStandardSearch.aspx) and any other curriculum materials available to the teacher (you may use interviews of the teachers, parents or administrators, and/or observations). The National Core Standards are available at the http://www.corestandards.org/the-standards/mathematics. When reviewing these curriculum materials, think about how they implement the ideas discussed in this course (specially reading 1: Influences and directions; 2: Learning and teaching mathematics; and 3: Problem Solving). Textbooks are available at the CMC (Everyday mathematics and Scott Foresman series).
   4) Informally interview one (or more) student in your internship and assess his/her understanding of patterns, functions, or algebra (based on his/her grade level). Describe the assessment and the student’s understanding.
   5) Reflect on your field experience classroom and/or school cultural diversity, technology facilities, manipulatives and other instructional resources available to the teachers as it relates to the teaching of mathematics.
   6) Interview your cooperating teacher. How does he/she assess children’s mathematics understanding and achievement? What does he/she know about Response to Intervention (RtI)? Characterize the assessment used by the teacher according to the types discussed in the following link: http://ims.ode.state.oh.us/ODE/IMS/Assessment/FAQ/types_of_assessment.asp. If your cooperating teacher uses either performance tasks or portfolios as part of a mathematics assessment plan, ask the following questions: How does the teacher employ performance tasks or portfolios in assessing children?
   7) In your internship, ask for samples of students’ of the written mathematics work of at least two children. How would you assess the children understanding based on that written work?
   8) Interview one or two primary student(s) and assess his/her or their understanding of numbers and numeration by using activities and materials from the school textbook. Describe what you did and the materials you used. Compare the two students' understanding of number and place value.
Identify questions you asked to help students clarify their thinking. Reflect on "next steps" you would take with each of the students.

9) Try an assessment of place-value with a student in your internship. Describe what materials you used and how the student responded. What did you do to clear up misconceptions the student may have had about place value? What questions helped you clarify the child's thinking?

10) Reflect on the following ideas: What does it mean to show equivalent representations of a mathematical concept or skill? Give an example from your field experiences involving equivalent representations of a mathematical concept or skill (including grade level, description of concept or skill and different representations used). Why is it important that children understand this concept or skill using equivalent representations? What concepts does the child appear to understand well? Does the child have any misunderstanding or limited understanding? What factors might have contributed to these misunderstandings?

11) Assessing Mathematics Understanding: Administer an assessment to a child and analyze his or her understanding of these topics. What concepts does the child appear to understand well? Does the child have any misunderstanding or limited understanding? What factors might have contributed to these misunderstandings?

12) Based on the student’s performance on the assessment (item 10 above), what would your next lesson with the child focus on? What would the objective of the lesson be? Describe an activity or problems that you would include in this lesson, and explain why you would include them. Explain how these next steps follow from your analysis of student understanding. If possible, you should also try to carryout the activities with the student.

Reading/Viewing Reflection and Field Experience III:

a. Reading/Viewing Reflection 3: Do activity 1 and select two (2) of the other activities (5 points each):


2) In what ways can you encourage students to translate real-life problems into representative models? Why should word problems precede memorization of basic facts? When should you introduce mathematical symbols? What can you do to avoid teaching misconceptions about multiplication and division?

3) Watch one of the video reflections and answer the discussion questions for this video: Illuminations: Learning about Area, Perimeter, and Fraction, with and form Peers: http://illuminations.nctm.org/Reflections_6-8.html.

4) What models and symbolic representations do/will you use to help your students master basic facts? How can “knowing math properties” reduce the number of facts students have to memorize? What consolidating activities are appropriate practice activities for your students?

5) Why is it important to learn more than one way to solve problems?

6) How can you help your students communicate their thinking, and why is it important for students to engage in discourse about mathematical ideas?

7) What is an algorithm in mathematics? What is the benefit of having students invent their own algorithms?

8) What can you do to improve computational fluency in your classroom? Why is it important to allow students to use various methods and algorithms?

9) How can estimation and mental math help your students check the reasonableness of their solutions? What strategies will help your students improve their estimation skills?

10) When is it appropriate to teach traditional algorithms for addition, subtraction, multiplication, and division?


Introduction: In this video clip, students are given word problems to solve. Be ready to identify the operation needed and to explain how each word problem can be modeled with objects.

a) In this clip, three students are given the same problem, though the wording varied a little. The basic problem was the following, “A child had 6 items. How many more items does he/she need to collect to have 13 altogether?” What strategy did the first child, Nicole, use to solve the problem?

b) For what whole number operation might this problem be used?


Introduction: In this video clip, a student, Dillon, is given word problems to solve. Be ready to identify the operation needed and to explain the reasoning and strategies that you think he used.

IMAP—Dillon


a) In this clip, the second problem posed is this: “Dillon has 14 colored marbles. Eight are blue, and the rest are red. How many red marbles does Dillon have?” What whole-number operation does the student think is needed? How does he solve the problem? What reasoning do you think he was using? What should he have done instead? (Also note the second problem he was given and how he solved it in a similar manner.)

b) The same student was given the following problem: “Dillon has 9 marbles, and Ismael has 4 marbles. How many more marbles does Dillon have than Ismael?” What strategy did he use to solve this problem? What type of problem was it? How does it compare to the first problem we examined (in Question 1?)

c) How did Dillon react to this problem? “A pack of gum has five pieces. How many pieces of gum would you have altogether if you had three packs of gum?” Were you surprised that he had no trouble with this problem when some of the subtraction problems were troublesome to him? How might you explain that situation?

d) Dillon was given two types of division problems. Contrast the two types of division problems and the strategies that he used to solve each problem correctly.


In this clip, Nicole uses cubes to solve a division problem. Then she learns that she used the wrong number, so she revises her answer. Notice the strategy that she uses and the comprehension that she demonstrates as she revises her solution.

IMAP – Modeling as a Strategy


a) In this clip, Nicole is given the same M&M problem that Dillon solved: Determine how many M&Ms each of three children will receive if they are sharing 18 M&Ms evenly. At first, she used cubes to solve the problem for 15 M&Ms and stated that each child would receive 5 M&Ms because there were 15 M&Ms. When the interviewer reminded her that there were 18 M&Ms, she quickly used the cubes to show the correct answer to the problem. What do you think she was thinking as she reasoned her way to this solution?

14) Topics: Whole-Number Operations: Assignment and Activities: Understanding the Commutative Property of Addition: Media Asset: Commutative Property of Addition

Once students understand the concepts on an operation and can easily use reasoning to find answers to word problems, they should be encouraged to memorize the basic facts. In this clip of a professional development activity, Dr. Branca demonstrates how the use of the commutative property for addition and the inverse operation (subtraction) can help students learn the basic facts in addition and subtraction. Thus, the students can learn to consolidate activities for drill and practice.

Commutative Property of Addition


a) How does the use of property allow students to recall the answers to basic addition facts they have not yet memorized?

b) How does the use of the inverse property allow students to use their knowledge of addition
factors to help them recall the answers to subtraction facts?

15) Topics: Whole-Number Operations: Assignment and Activities: Understanding the Commutative Property of Multiplication: Commutative Property of Multiplication

**Introduction:** Once students understand the concepts of an operation and can easily use reasoning to find answers to word problems, they should be encouraged to memorize the basic facts. In this clip of a professional development activity, Dr. Branca demonstrates how the use of the commutative property for multiplication and the inverse operation (division) can help students learn the basic facts of addition and subtraction. Thus, the students can learn to consolidate activities for drill and practice.

**Commutative Property of Multiplication**


a) How does the use of property allow students to recall the answers to basic multiplication facts they have not yet memorized?

b) How does the use of the inverse property allow students to use their knowledge of multiplication facts to help them recall the answers to division facts?


**Introduction:** Gretchen, a second-grade student, attempts to solve the subtraction problem 70 – 23 and has difficulty using an algorithm. She then uses place value blocks to help her solve the problem. Her comments give insights into the reasoning that she is using to complete the computation.

**IMAP - Multiple Strategies to Solving Problems**

http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectId=mathmethods&clipID=IMAP_Gretchen_2ndGrade_03.flv

a) Notice each of the ways Gretchen attempted to solve the problem 70 – 23. What mistake did she make to get the incorrect answer using the standard algorithm? Is this a common error? Why might Gretchen have made this error?

b) Why do you think Gretchen felt so strongly that the answer she got by using the standard algorithm was correct? How might the teacher help Gretchen with a bridging algorithm?

17) Topics: Estimation & Computation with Whole Numbers: Assignment & Activities:

**Introduction:** In this clip, we are able to examine Javier’s reasoning when he is asked how many eggs are in six dozen and how many eggs are in 12 dozen. He solves the problems using mental computation. Then he uses written strategies to help explain his answers. Notice the strategies that he uses to arrive at his answers.

**IMAP - Solving Multiplication**

http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectId=mathmethods&clipID=IMAP_Javier_06.flv

a) Javier appeared to know that 5 x 12 is 60. However, when the interviewer questioned him about it, he explained how he figured out that part of the answer, demonstrating another strategy he used. Explain Javier’s way of thinking. What is the logic behind his strategy?

b) How did Javier show that he could think flexibly about numbers? Why did Javier’s strategies work? How does the use of this type of strategy compare to relying only on memorizing the multiplication facts of 12.

18) Topics: Estimation & Computation with Whole Numbers: Assignment & Activities: IMAP – Making Sense of Solutions:

**Introduction:** A teacher poses a story problem that requires the use of multiplication to solve it. Notice the models that students choose to help them solve the problem. Also, pay attention to how the children explain their problem-solving strategies and their reasoning.

**IMAP - Making Sense of Solutions**

http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectId=mathmethods&clipID=IMAP_Grade_1_Class_17.flv

a) Explain how Mrs. Kick engaged the children in mathematical problem solving. How did she encourage the children to communicate their mathematical thinking?

b) How did the children use models to demonstrate the operation of multiplication?

19) Topics: Estimation and Computation with Whole Numbers: Assignment and Activities:
Equations:

**Introduction:** In this video, the teacher is using small groups to help students develop meaning for addition and subtraction. Pay attention to how this grouping facilitates the students' involvement in the lesson and their use of models to understand the addition equation.

**Equations**


a) Why does the teacher put the students in small groups to solve addition and subtraction questions? Which NCTM standards do you see represented in this lesson?

b) How did the teacher use NCTM process skills to help the students develop the concepts needed to solve the word problem she posed?

**b. Field experience 3 (10 points):** Select two (2) of the following activities:

1) **Read the Common Core State Standards (CCSS)** (http://www.corestandards.org/the-standards/mathematics) for one grade level (Kindergarten through grade 5) on Number and Operations in Base Ten.
   After reading the standards, what additional connections do you see between the content you studied in this course and implications for your classroom teaching (field experiences)? Give examples.
   What are some insights you acquired about the development of children's understanding of Number and Operations in Base Ten for the selected grade?
   What are three important ideas you want to remember from the standards when teaching Number and Operations in Base Ten?

2) Assume that you need to report back to your grade-level team or to the entire school staff at a faculty meeting on your experiences and learning in this course. What are the main messages about the teaching of data analysis, statistics, and probability you would share with your colleagues? Prepare a one-page handout or an overhead or slide that could be distributed or shown at the meeting.

3) Look at a lesson or activity in your own mathematics program for your grade level that you think has potential for developing students' statistical reasoning. If you were to use this lesson or activity now, after taking this course, how might you modify or extend it to bring out more of the important ideas about data analysis, statistics, and probability?

4) Reflect on your field experience classroom and/or school cultural diversity, technology facilities, manipulatives and other instructional resources available to the teachers as it relates to the teaching of mathematics.

5) Interview your cooperating teacher. How does he/she assess children’s mathematics understanding and achievement? What does he/she know about Response to Intervention (RtI)? Characterize the assessment used by the teacher according to the types discussed in the following link: http://ims.ode.state.oh.us/ODE/IMS/Assessment/FAQ/types_of_assessment.asp. If your cooperating teacher uses either performance tasks or portfolios as part of a mathematics assessment plan, ask the following questions: How does the teacher employ performance tasks or portfolios in assessing children?

6) In your internship, ask for samples of students’ of the written mathematics work of at least two children. How would you assess the children understanding based on that written work?

7) Interview one or two primary student(s) and assess his/her or their understanding of numbers and notation by using activities and materials from the school textbook. Describe what you did and the materials you used. Compare the two students' understanding of number and place value. Identify questions you asked to help students clarify their thinking. Reflect on "next steps" you would take with each of the students.

8) Try an assessment of place-value with a student in your internship. Describe what materials you used and how the student responded. What did you do to clear up misconceptions the student may have had about place value? What questions helped you clarify the child's thinking?

9) Reflect on the following ideas: What does it mean to show equivalent representations of a mathematical concept or skill? Give an example from your field experiences involving equivalent representations of a mathematical concept or skill (including grade level, description of concept or skill and different representations used). Why is it important that children understand this concept or skill using equivalent representations? What concepts does the child appear to understand well?
Does the child have any misunderstanding or limited understanding? What factors might have contributed to these understandings?

10) Assessing Mathematics Understanding: Administer an assessment to a child and analyze his or her understanding of these topics. What concepts does the child appear to understand well? Does the child have any misunderstanding or limited understanding? What factors might have contributed to these understandings?

11) Based on the student’s performance on the assessment (item 10 above), what would your next lesson with the child focus on? What would the objective of the lesson be? Describe an activity or problems that you would include in this lesson, and explain why you would include them. Explain how these next steps follow from your analysis of student understanding. If possible, you should also try to carry out the activities with the student.

Reading/Viewing Reflection and Field Experience IV:

a. Reading/Viewing Reflection 4: Do activity 1 and select two (2) of the other activities (5 points each):

1) Write a reflection for the following reading: Geometry: Session 10: Classroom Case Studies:
Choose a grade band:
http://www.learner.org/courses/learningmath/geometry/session10/index.html

2) Write a reflection for the following reading: Measurement: Session 10: Classroom Case Studies:
Choose a grade band:
http://www.learner.org/courses/learningmath/measurement/session10/index.html

3) Why is it important to use concrete models and words for fractions before moving to symbols? Which of the models are often neglected when teaching fractions? How can you encourage your students to order and compare fractions? How do the activities in classroom textbook broaden students’ understanding of fractions? Give examples.

4) What prior knowledge must students have before they can learn fraction computation? What steps can you take to help your students develop operation sense? What manipulatives will you use to teach fraction computation with meaning?

5) Select an activity from our classes that helped broaden your own understanding of a fraction concept. Describe your thinking as you completed the activity. How might you adapt this activity for your students?

6) Topics: Fraction Concepts and Computation: Assignment and Activities: A Lesson on Fractions:
A Lesson on Fractions
Introduction: The purpose of this activity is to explore ways to use models to represent fractions and to think about how those models can help students develop mathematical concepts related to fractions.
A Lesson on Fractions
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=MMET_007_278.flv
a) What models were used to represent fractions? Are there similar models that could be used?
b) Why were models used to represent fractions?
c) What was the main concept that students modeled in this video? Why is this idea an important concept for students to develop?
d) What other basic understandings are the students developing without even realizing it? From this video, what do you think are some of the concepts students should understand about fractions?

Introduction: For this objective, you will view two video clips. In the first video, students were presented with the following problem: Aisha is 12 and is excellent at playing video games. The company that designs the games asked her to play three games for one hour each. On Alien Attitude she completed two out of the three levels in the game. Basketball Boyz has four levels, and she completed three of them. She completed five out of eight levels on Dance Diva. Which game did she come closest to completing? Solve the problem and explain your reasoning.
In the second video clip, you will see a student named Jacky who thinks that one-seventh is larger than two-sevenths. You will explore her reasoning and her teacher’s comments to try to determine the basis for her misconception.

**Media Asset 1**: Using Fractional Models  

**Media Asset 2**: IMAP - Comparing Fractions  

a) What is the purpose of the instructional task in the first clip?

b) Based on the explanations in the second clip that Jacky gives as she correctly draws the fraction and incorrectly answers the question, “Which is larger: one-seventh or two-sevenths?” and based on the explanation that her teacher offers, what do you think is the basis for her misconception about which fraction is larger?

c) What might Jacky’s teacher do to foster correct understandings and to help students accurately compare fractions?

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**Introduction**: In this video, Felicia, a second-grade student who has not received instruction on how to add and subtract fractions, is able to add 3/4 + 1/2 by using picture models that she draws. She explains her reasoning for the answer that she provides. Thus, the video offers insight into her development of operation sense for fractions.

**IMAP - Developing Operations Sense for Fractions**  

a) Explain Felisha’s thinking. List the fraction concepts on which Felisha is drawing in this solution.

b) How do Felisha’s drawings and explanation show the operation sense that she is developing?

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9) Topics: Fraction Concepts and Computation with Whole Numbers: Assignment and Activities: IMAP – Developing Operations Sense for Fractions:

**Introduction**: You will view a video clip of Elliot, a sixth-grade student, who is asked to solve two division problems, 1 divided by 1/3 and 1 1/2 divided by 1/3.

**IMAP - Meaning of Division of Fractions**  

a) What, specifically, would children understand if they comprehended the division of fractions?

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**Introduction**: You will watch a video of Felisha, a student who, at the end of fourth grade, is asked to explain how much cookie each person would get if five people fairly shared two cookies. The interviewer explores Felisha’s thinking about her answer: “Each person would get 1/5 of each cookie or 2/10 with the cookies added together.”

**IMAP - Models for Understanding Operations on Fractions**  

a) What is the mathematical problem posed by the task presented to Felisha, which is to determine how much cookie each person would get if five people fairly shared two cookies? What model did Felisha use to represent the problem and to attempt to find the solution? What was the error of her reasoning?

b) How might the teacher help Felisha to understand the concept correctly?

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Introduction: You will view a video in which an interviewer talks to a student named Ally about fractions. For Ally, fractions seem to be comprised of a discombobulated set of procedures for which she has few conceptual anchors. See if you can identify some of Ally’s misconceptions.

IMAP - Fraction Misconceptions

a) Identify three misconceptions Ally holds about fractions. (Ally’s misconceptions are held by many students.)
b) Based on the interview with the teacher at the end of the clip, what do you think might have contributed to Ally’s misunderstandings?


Introduction: In this video clip, students are choosing which of two decimal numbers is larger. Examine their answers and their explanations to analyze their understanding and their misconceptions.

IMAP—Decimal Assessments
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Decimal_Assessments_08.flv

a) How would you summarize the students’ misconceptions related to comparing decimal numbers?
b) What are some models that teachers might use to help students form accurate concepts about the size of a decimal number? How might the teacher connect the decimal number to a fraction or whole number to increase the students’ understanding of decimals? How could the teacher use place value blocks to help the student see the values of .18 and 1.8?

13) Topics: Decimals Concepts and Computation: Assignment and Activities: IMAP – Decimal Work with Base Ten Blocks: Using Fractional Models and IMAP – Megan and Donna, Fifth Grade:

Introduction: In this video clip, students are choosing which of two decimal numbers is larger. Examine their answers and their explanations to analyze their understanding and their misconceptions.

IMAP—Megan and Donna, Fifth Grade
http://abavtooldev.pearsoncmg.com/myeducationlab/singleplay.php?projectID=mathmethods&clipID=IMAP_Megan_and_Donna_5th_grade_09.flv

a) Two fifth-graders, Megan and Donna, attempt to model 1.8 with base ten blocks. How do they use the blocks to represent 1.8 on the first attempt? When the interviewer suggests the girls use a “long” (10-cube block) to model 1.8, how do the girls show the number? How are their two methods alike? What misconceptions are they demonstrating by creating this model?
b) As a teacher, how would you want Megan and Donna to use the blocks to represent 1.8? Why is it important to help them correct their misconceptions and to make sure that they build an understanding of decimals?

14) Topics: Decimals Concepts and Computation: Assignment and Activities: IMAP – Addition and Subtraction of Decimals: Using Fractional Models and IMAP – Brooke, Fifth Grade:

Introduction: In this clip, a student draws a model to show how to solve 4 – 7/10. Notice how she models this subtraction problem and explains the solution process.

IMAP—Brooke, Fifth Grade

a) In this clip, a student is asked to solve 4 – 7/10. How does the model this student draws demonstrate her understanding of the problem and its solution?
b) How does the student demonstrate that she understands the concept that decimals are related to whole numbers and fractions?


Introduction: For this activity, you will view two short clips. One is from a classroom lesson, and the other is from interviews conducted with students and the teacher after the lesson. In the lesson, the students were asked to create various values of numbers by placing a decimal point into the two numbers and then adding the numbers to try to get a target value. Notice how the students
explain their work. Finally, note what the teacher concludes from the lesson.

**Clip 1: Lesson: Placing Decimal Points**  

**Clip 2: Student Reaction to Working With Decimals**  

**a)** The teacher gave the students some problems in which they had to figure out where to place the decimal points in the numbers and then they had to add the numbers. What was similar about each group’s presentation of the solution to one of the problems?

**b)** Did your evaluation of the students’ understandings match the teacher’s comments?

**b. Field experience activity 4 (10 points):** Select two (2) of the following activities:

1) Interview your cooperating teacher: What models do you use to represent fractions? How do you make your students more aware of fractions and decimals in their environment? What do you do to help your students develop fraction and decimal number sense? In what ways do you help your students connect fractions and decimals?

2) Assessing Mathematics Understanding: Administer an assessment of your choice to a child and analyze his or her understanding of these topics. What concepts does the child appear to understand well? Does the child have any misunderstanding or limited understanding? What factors might have contributed to these understandings?

3) Informally interview one or two students in your internship to assess their understanding of fraction concepts, comparison, equivalence, or operations. Describe their understanding.

4) Based on the student’s performance on the assessment (above in 4), what would your next lesson with the child focus on? What would the objective of the lesson be? Describe an activity or problems that you would include in this lesson, and explain why you would include them. Explain how these next steps follow from your analysis of student understanding. If possible, you should also try to carry out the activities with the student.

5) Informally interview one or two children to assess their understanding of data analysis, statistics or probability. Describe their understanding and misconceptions. Where would you place their thinking related to the van Hiele levels of geometric thought?  
See Van Hiele Level of Geometry Reasoning for more information:  
http://images.rbs.org/cognitive/van_hiele.shtml

6) Interview a teacher in the grade level above you. Show the teacher the Cutting Corners activity (http://www.learner.org/courses/learningmath/geometry/session10/part_c/indexk2.html), and ask him or her the following questions:  
How does the content of this activity prepare students for geometric thinking in your grade? Why do you think this content is important? How could this activity be extended for students in your grade?

7) Look at a lesson or activity in your own mathematics program for your grade level that you think has potential for developing students' geometric reasoning. If you were to use this lesson or activity now, after taking this course, how might you modify or extend it to bring out more of the important ideas about geometry?

8) Assume that you need to report back to your grade-level team or to the entire school staff at a faculty meeting about your experiences and learning in this course. What are the main messages about the teaching of measurement you would share with your colleagues? Prepare a one-page handout or an overhead or slide that could be distributed or shown at the meeting.

9) Look at a lesson or activity in your own mathematics program for your grade level that you think has potential for developing students' reasoning about measurement. If you were to use this lesson or activity now, after taking this course, how might you modify or extend it to bring out more of the important concepts about measurement?

10) Informally interview one or two students in your internship and assess their understanding of measurement (based on their grade level). Describe their understanding.

2. **Manipulative Exams (60 points each):** Each student will complete two manipulative exams emphasizing teaching techniques involving manipulative materials. **Manipulative Exam 1** could involve problems using manipulatives to teach operations concepts (cubes, Cuisenaire Rods),
computation with whole numbers (Base-ten Blocks and chip trading materials), patterns (pattern blocks), and sorting and classifying (attribute blocks). **Manipulative Exam 2** (Final Exam) could involve problems using manipulatives to teach fractions (Fraction Tiles, Cuisenaire Rods) and decimal computation (Base-ten Blocks and chip trading materials), algebra (algebra tiles), integers (two-color chips), measurement, proportion, percent, and geometry (geoboard and tangrams).

3. **Lesson Plans (40 points each):** Students will develop and teach (to a small group of students or the whole class during the field experiences) two conceptually based mathematics lesson designed to promote and evaluate students’ higher order thinking skills and problem solving abilities. The appropriate use of manipulatives, problem solving, connections, communication, or reasoning to meet students’ needs (including ESOL and ESE students) must constitute a portion of the instructional time in the lesson plan. The lesson can be integrated with other content areas (for example, art, music, social studies, science, language arts, and/or reading). You must use the form and guidelines provided in class to receive credit.

You need work with your cooperating teacher to select the topic of these lessons, and **have the cooperating teacher sign the lesson plan before teaching it, and turning it to me.** You may turn in the final version of the lesson plan as you have it ready for evaluation and feedback. The instructor and/or other students during class may review these lessons.

**These lesson plans should follow the guidelines given in class** (points will be deducted if they are not followed). The lesson form will be sent to you as an e-mail attachment. (FEAP 1; **ESOL 2, 3, 5, 6, 7, 11, 12, 14, 15, 16, 18, 19**)

**Use one of the Lesson Plans as Required Evidence for the Assessment Section of your Professional Portfolio.**

**Lesson Plan Preplanning** (10 points out of the 40 points)
Student gathers and analyzes appropriate data regarding learning needs of students; uses or adapts resources to meet assessed needs of individual students; and identifies appropriate teaching strategies to meet individual learning needs.

This assignment is the first part of the lesson plan. All parts of the lesson will be uploaded into LiveText as one document titled “Lesson Plan.”

Please note: students will not receive a passing grade in the course until this assignment is uploaded into the LiveText portfolio!

**LiveText Evaluation Guidelines and Rubric for Lesson Preplanning:** In terms of students’ learning needs, assess the practitioner’s ability to gather data as appropriate or inappropriate, and then assess his/her data analysis as appropriate or inappropriate. Based on the practitioner’s performance on these two areas, select the word that best describes the practitioner’s combined performance as UNACEPABLE, DEVELOPING, or PROFICIENT (see third column of the table below). A description of these choices is given in last column.
<table>
<thead>
<tr>
<th>Gathers Data</th>
<th>Analyzes Data</th>
<th>Select one</th>
<th>Our Developing Rubric Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inappropriate</td>
<td>Inappropriate</td>
<td>[ ] UNACCEPTABLE</td>
<td>Neither gathered nor analyzed appropriate data in terms of students’ learning needs.</td>
</tr>
<tr>
<td>Appropriate</td>
<td>Inappropriate</td>
<td>[ ] DEVELOPING</td>
<td>Gathered appropriate data, but did not analyze the data appropriately in terms of students’ learning needs.</td>
</tr>
<tr>
<td>Appropriate</td>
<td>Appropriate</td>
<td>[ ] PROFICIENT</td>
<td>Gathered appropriate data and analyzed the data appropriately in terms of students’ learning needs.</td>
</tr>
</tbody>
</table>

**Specific Guidelines:**
You will be expected to develop and teach a whole-class, conceptually based mathematics lesson involving substantial use of manipulatives. The lesson plan must include at least the following (a more complete set of guidelines will be given in class):

- Intended grade level
- Topic
- Specific Objective(s) – both mathematics and critical thinking
- Complete reference for children’s book chosen with justification for the use of this book to teach the mathematics and critical thinking objective(s)
- Materials used (what materials and how many of each)
- Prerequisite knowledge required
- Motivational activity – must be an appropriate lead-in to the problem
- Specific procedures
- Closure
- Provisions for assessment throughout the lesson
- Plan for addressing needs of diverse learners (ESE, ESOL, special needs children, etc.) throughout the lesson
- Copies of all written materials used (if any)

The lesson plan should be complete enough that a substitute teacher could teach your lesson without talking with you beforehand. [Course Objectives: 2, 3, 5, 6, 7, 8, 11]

4. Informal Assessment (60 points): More guidelines will be given in class.

**Diagnosis (40 points): First,** conduct an informal diagnosis or investigation of at least one student. This involves the selection of the student(s) based on his/her weaknesses or misconceptions in mathematics. Select one student and describe his or her an error pattern or weakness observed (skill or concept), include a description of how you know the student has this weakness in mathematics, and possible prerequisites needed to master this skill or concept. This information can be collected through informal observation, by analyzing assignment or handouts, and more informal interviews with the child. Also, interviews of teachers and/or parents could be used to collect data. The idea here is to collect and analyze as much information about the child’s weakness and strengths. No teaching is necessary for the diagnosis. FEAP 1 (Assessment)
Prescription (20 points): Second, after the informal diagnosis, you need to explain how you could help the student overcome the weakness or misconception discovered. You should also take into account the student’s interests and motivation, and the NCTM Standards (problem solving, communication, connection, logical reasoning). You are not required to teach the suggested activities. Provide details for your plans and indicate how you used the diagnosis portion of the informal assessment to develop your prescription.

You need to work with your cooperating teacher to select the student for this report, and have the cooperating teacher sign the report before turning it to me. The student should have a specific difficulty with mathematics skills and/or concepts. You may turn in the final version of the report as soon as you have it ready for evaluation. I will not accept reports without the cooperating teacher’s signature.

This informal assessment should follow the guidelines given in class (points will be deducted if they are not followed). The guidelines and evaluation rubric will be sent to you as an e-mail attachment.

B. Evaluation Procedures:
Grades will reflect the extent to which the student shows:
1. How to teach mathematics concepts and skills - what techniques and materials are most appropriate and why,
2. The bases for decisions on what and how to teach mathematics,
3. How to apply theory to the teaching of mathematics,
4. How to develop creative and effective instructional materials.

Points will be assigned to the following list of assignments. Maximum points for each is noted.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Reflections &amp; Field Experience Activities (4 @ 25 points each)</td>
<td>100 points</td>
</tr>
<tr>
<td>Lesson Plans (2 @ 40 points each)</td>
<td>80 points</td>
</tr>
<tr>
<td>Manipulative Exams (2 @ 60 points each)</td>
<td>120 points</td>
</tr>
<tr>
<td>Informal Assessment</td>
<td>60 points</td>
</tr>
<tr>
<td>Participation &amp; Attendance</td>
<td>30 points</td>
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<tr>
<td><strong>Total:</strong></td>
<td><strong>390 points</strong></td>
</tr>
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Grades will be assigned according to the following scale:

<table>
<thead>
<tr>
<th>Points</th>
<th>Percentage</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>341 (90%)</td>
<td>390 (100%)</td>
<td>A</td>
</tr>
<tr>
<td>312 (80%)</td>
<td>340.9 (89.9%)</td>
<td>B</td>
</tr>
<tr>
<td>273 (70%)</td>
<td>311.9 (79.9%)</td>
<td>C</td>
</tr>
<tr>
<td>234 (60%)</td>
<td>272.9 (69.9%)</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>233.9 (60%) or below</td>
<td>F</td>
</tr>
<tr>
<td>Date</td>
<td>Topics/Readings</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Aug. 22</td>
<td><strong>Course Overview</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Aug. 29 | **Topics:** CRA Learning Levels (concrete, representational, and abstract); Teaching Mathematics: Influences and Directions; Learning and Teaching Mathematics; & Developing Mathematical Thinking and Problem Solving Ability.  
**Topics:** Assessing Mathematical Understanding; & Developing Number Concepts  
**Review:** Response to Intervention (RtI) – Teaching Learning Connections  
**Informal Assessment Guidelines**  
**Lesson Plan Guidelines**  
**Read:** Young DP Introduction to Diagnosis and Prescription |
| Sept. 5  | **Topics:** Developing Understanding of Numeration  
**Also read:** Young DP Pre-number and Beginning Numbers |
| Sept. 12 | **Topics:** Developing Whole Number Operations: Meaning of Operations; & Developing Whole Number Operations: Mastering Basic Facts  
**Read:** Introduction to Addition & Subtraction: Young DP Paper Mult. & Division  
**Due Online** (Sept. 12): **Reading Reflection and Field Experience Activity I** |
| Sept. 19 | **Topics:** Developing Whole Number Operations: Meaning of Operations; & Developing Whole Number Operations: Mastering Basic Facts |
| Sept. 26 | **Topics:** Estimation and Computational Procedures for Whole #s; & Error Analysis for Whole Number Computation  
**Review for Manipulative Exam 1**  
**Also read:** Young DP Paper Place Value  
**Due Online** (Sept. 26): **Reading Reflection and Field Experience Activity II** |
| Oct. 3   | **Manipulative Exam 1** |
| Oct. 10  | **No Class:** Internship I: Full Week of Teaching 1st Placement: Oct. 8 – Oct. 12  
**Internship I – Second Placement Begins – October 15** |
| Oct. 17  | **Topics:** Developing Fraction Concepts; & Developing Fraction Computation  
**Due Online** (Oct. 17): **Lesson Plan 1 and Informal Assessment** (Remember to get Supervising Teacher’s signature for Lesson Plan and Informal Assessment) |
| Oct. 24  | **Topics:** Developing Decimal Concepts and Computation; & Error Analysis for Fractions & Decimal Computation  
**Due Online** (Oct. 24): **Reading Reflection and Field Experience Activity III** |
| Oct. 31  | **Understanding Ratio, Proportion, & Percent**  
**Due Online** (Oct. 31): **LiveText Professional Portfolio:** Upload Lesson Plan 1 |
| Nov. 7   | **Topics:** Developing Geometric Thinking and Spatial Sense |
| Nov. 14  | **Topics:** Developing Measuring Concepts & Skills; Collecting, Organizing, & Interpreting Data  
**Review for Manipulative Exam 2**  
**Due Online** (Nov. 14): **Reading Reflection and Field Experience Activity IV** |
| Nov. 21  | **Continued Review for Manipulative Exam 2**  
**Thanksgiving Holidays – November 22 – November 24** |
| Nov. 28  | **No Class:** Internship I: Full Week of Teaching 2nd Placement Nov. 26 – Nov. 30 |
| Dec. 5   | **Manipulative Exam 2:** Final Exam  
**Due Online** (Dec. 5): **Lesson Plan 2** (Remember to get Supervising Teacher’s signature for Lesson Plan)