

**EDIC 582: Number and Operations Instruction for Grades 3-5**  
**Eastern Mennonite University**  
**Fall 2010**

**Instructors:** Toni M. Flanagan, EdD; John Matherly, M.S.  
**Phone:** (540) 245-5117  
**Email:** [jmatherly@augusta.k12.va.us](mailto:jmatherly@augusta.k12.va.us) ([toni.flanagan@emu.edu](mailto:toni.flanagan@emu.edu))  
**Course dates:** Thursdays, September 2<sup>nd</sup> to December 16<sup>th</sup>  
**Location:** Riverheads Elementary School  
**Time:** 4:00 to 7:00 p.m.  
**Credits:** 3 graduate credits

**I. COURSE DESCRIPTION:**

This course will develop an understanding of how children in grades – 3-5 learn mathematics, with a focus on how students learn to reason with numbers, to compute fluently, to communicate effectively in mathematics classrooms, and to solve significant mathematics tasks. The course will examine current best practices in mathematics education as well as mathematics research based on the findings of the National Mathematics Advisory Panel. The course will be designed around three primary objectives: (1) teachers need a deep understanding of the mathematics students are learning throughout elementary school; (2) teachers need to understand pedagogical practices as they relate to mathematics; and (3) teachers need to understand how students learn mathematics.

**II. PURPOSE:**

To deepen the teacher's knowledge and understanding of the mathematics taught at the upper elementary level; to develop a knowledge and understanding of mathematics-specific pedagogy; to provide experiences that will enhance the teacher's competence and confidence in mathematics and effective mathematics instruction; to practice and implement mathematics instruction based on a student's needs; and to use the classroom context as a laboratory for learning about mathematics instruction.

**III. EMU CONCEPTUAL FRAMEWORK:**

**“Preparing Caring, Reflective Teachers for a Changing World”**

The EMU Teacher Education Program has chosen the theme *Preparing Caring, Reflective Teachers for a Changing World*” as the conceptual framework from which its beliefs and outcomes are based. The Teacher Education Program envisions preparing informed lifelong leaders and learners who value the dignity of all persons and are ready and willing to share a pilgrimage of openness and continuous growth as they invite others to join them. These caring, reflective educators will offer healing and hope in a diverse world. Six performance outcomes focus all course and candidate outcomes.

#### **IV. M.A. IN EDUCATION PROGRAM OUTCOMES:**

**Scholarship:** to acquire advanced knowledge through core curriculum and specialty area courses and to organize and integrate that knowledge into professional practice. **(S)**

**Inquiry:** to generate questions and to use critical thinking to self-assess, to view problems from multiple perspectives, to make informed decisions and to engage in action research for educational change. **(I)**

**Professional Knowledge:** to acquire advanced pedagogical and specialty area knowledge in order to create cultures of change and manage environments conducive to learning, setting high expectations and implementing appropriate instructional and assessment practices. **(PK)**

**Communication:** to develop communication strategies (verbal, nonverbal, and technological), which support collaboration and resourcefulness to empower self and others. **(C)**

**Caring:** to develop a nurturing spirit that advocates for students, encourages social and ethical responsibility, and promotes peace building in diverse settings. **(Ca)**

**Leadership:** to act as social change agents by working collaboratively to bring about fair and just systemic change within educational contexts. **(L)**

#### **V. COURSE OUTCOMES:**

**The student will:**

1. Develop a deeper understanding of number systems and how to reason with numbers. **(S, I)**
2. Strengthen knowledge and understanding of arithmetic and problem solving, including whole and rational numbers. **(S, I)**
3. Use assessment data to plan mathematics instruction based on identified strengths and needs of the student. **(PK, Ca)**
4. Develop and use progress-monitoring assessments to ensure that students are responding to mathematics instruction. **(PK)**
5. Implement NCTM's process standards for mathematics to complement state and national content standards. **(PK, L)**
6. Modify instructional practices to show how computational fluency is acquired through stages of development; conceptual knowledge, computational strategies, and automaticity. **(PK)**

7. Apply current mathematics and educational research to design instruction that is based on a child's individual strengths and needs. (S, I, C)
8. Create lessons and units around significant mathematical tasks, differentiated instruction and power standards. (PK)

## VI. RATIONALE:

Research in mathematics and its instruction has resulted in important conclusions:

- Teachers need a deep understanding of the mathematics they teach. (Hill, Ball, & Schilling, 2008; NCTM, 2007; Ma, 1999)
- Teachers need an understanding of the instructional practices specific to mathematics. (NCTM 2007; Ball, Hill, & Bass, 2005; Ma, 1999)
- Teachers should emphasize conceptual understanding before procedural proficiency. (National Research Council, 2001, NCTM 2000)
- Students should engage in significant mathematical tasks. (Stein, Smith, Henningsen, & Silver, 2000; Hiebert et al., 1997)
- Explicit instruction in mathematics benefits students when it is purposefully designed to meet documented learner needs. (Allsopp, Kyger, & Lovin, 2007)
- The National Mathematics Advisory Panel Report (2008) emphasizes that preparation for Algebra requires students to simultaneously develop conceptual understanding, computational fluency, and problem solving skills. Proficiency with fractions is an essential goal of K-8 mathematics education in the preparation of students for Algebra. Proficiency with whole numbers is a necessary pre-requisite.

## References

- Ball, D., Hill, H. & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how do we decide? *American Educator*, 14-46.
- Ball, D.L., Thames, M.H., & Phelps, G. (2008, Nov/Dec). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 389-407.
- Cohen, D.K. & Ball, D.L. (2001, September). Making change: Instruction and its improvement. *Phi Delta Kappan*, 83(1), 73-77.
- Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H., Olivier, A. & Human, P. (1997). *Making Sense: Teaching and learning mathematics with understanding*. Portsmouth, NH: The University of Wisconsin Foundation.
- Hill, H.C., Ball, D. L., Blunk, M., Goffney, I.M., Rowan, B. (2007, August). Validating the ecological assumption: The relationship of measure scores to classroom teaching and student learning. *Measurement* 5(2/3), 107-118.

- Hill, H.C., Blunk, M., Charalambous, C. Y., Lewis, J. M., Phelps, G.C., Sleep, L., Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and Instruction* 26(4), 430-511.
- Hill, H.C., Schilling, S.G., Ball, D.L. (2004). Developing measures of teachers' mathematics knowledge for teaching. *The Elementary School Journal* 105(1), 11-30.
- Ma, L. (1999). *Knowing and Teaching Elementary Mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- National Council of Teachers of Mathematics (2007). *Mathematics teaching today* (2nd ed.). Reston, VA: Author.
- National Council of Teachers of Mathematics (2000). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.
- National Mathematics Advisory Panel. (2008) *Foundations for success: The final report of the National Mathematics Advisory Panel*. Washington, DC: U.S. Department of Education.
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, and B. Findell (Eds.) Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.
- Price, J.N. & Ball, D.L. (1998). Challenges of liberatory pedagogy in mathematics education. *Theory into Practice*, 37(4), 256-264.

## **VII. INSTRUCTIONAL PROCEDURES:**

Class time will be allocated to lectures by the course instructor covering the topics outlined; student participation in the form of colloquia and informal discussion; demonstrations and appropriate interactions and responses to those demonstrations; and student projects.

## **VIII. REQUIRED TEXTBOOKS:**

Van de Walle, J. A. & Lovin, L. H. (2005). *Teaching Student-Centered Mathematics: Grades 3-5*. Columbus, OH: Allyn and Bacon/Merrill.

Outside readings will be assigned from various sources, including NCTM's *Teaching Children Mathematics* and ASCD's *Educational Leadership*.

## **IX. COURSE REQUIREMENTS AND METHODS OF EVALUATION:**

### **Assignments and Grading Procedures:**

#### **1. Attendance (10 points)**

All students are expected to contribute to this community of learners by attending each class and being a positive participant in discussions, presentations, and hands-on projects. You will lose 2 points for every missed class, which means that excused or unexcused absences could lower your final grade. (See attendance policy)

#### **2. Read all assigned material, participate in online group discussions (24 points: 3 pts per session for discussion)**

In order for our discussions to be meaningful, you must read the assigned readings prior to the discussion. You must be prepared to discuss the assigned text and articles and share ideas from your current teaching situations that will support the content of the current book talk.

During online discussions the instructor will provide a few prompts to begin each discussion. Students may respond directly to the prompt, directly to another student's response, or pose a new question. Each student will be expected to provide two (2) substantive posts per discussion, at least one of which is in direct response to a classmate. Substantive posts address the content of the assigned readings, share strategies and experiences from your classroom, or pose new questions that positively redirect the conversation. Please note that "me too" or "I agree" responses are **NOT** substantive.

#### **3. "Try it out" reflections (24 points – 3 reflections)**

You will be asked to try out 4 best practice ideas from the presentations and readings.

You will write a reflection on each of the following:

- a. Teaching with significant mathematical tasks: You will write up a lesson plan for the activity, teach the lesson and then reflect on the lesson. (8 pts)
- b. Analyzing student errors: You will analyze student errors from a classroom assessment and reflect on what you found and how to modify instruction as a result. Copies of student work should be provided. (8 pts)
- c. Conducting a diagnostic student interview: You will conduct a series of diagnostic student interviews using one of several interview protocols then reflect on what it tells you about those students and how it informs instruction. (8 pts)

#### **4. Mathematical Understanding (24 points)**

You will complete 4 Problem Sets (6 pts each) that are designed to challenge your understanding of the mathematics content being taught in the upper elementary grades.

### 5. **Application of Pedagogy (18 points)**

You may choose between several options to demonstrate that you can apply the pedagogy presented in the class. The project may be completed individually or in small groups and **MUST** be presented at the final class meeting.

- a. You may rewrite a unit of study that you have used in the past incorporating best practice standards gained in this class for how students best learn mathematics.
- b. You may design and teach a lesson, focused on a number sense concept, that implements tiered instruction to differentiate for the ability of your students. Your project will involve writing a description of the creation and implementation of the lesson and presenting your work.
- c. You may write a case study that shares the process of providing an intervention with a student (or group of students). The experience must highlight the assessments used to determine student need, the intervention(s) provided, the assessments used for progress monitoring and the decisions made for continuing, changing or discontinuing the intervention.
- d. You may choose an alternate project that represents a similar level of work understanding of the content presented in the course. This alternate project must be pre-approved by the instructor.

### **Course Evaluation/ Grading:**

Use of Graduate Level Writing Standards and American Psychological Association (APA) Writing Style

1. Assignments must be typed using 12-point type and 1" margins. Participants are expected to use *Publication Manual of the American Psychological Association 6th Edition* for written assignments. For the purpose of this class, reflections and lesson plans may be written in an informal style.
2. Assignments must be clearly written and free of obvious spelling and grammatical errors. The EMU Graduate Level Writing Standards will be used to evaluate written work. (Rubric found at: <http://www.emu.edu/academics/writing/writing-standards-graduate09.pdf>)

Your grade will be based on attending classes, preparing and reporting on assigned readings, handing in written assignments and participating in class projects.

Points/percentages equate to grades as follows:

|        |    |
|--------|----|
| 95-100 | A  |
| 92-94  | A- |
| 88-91  | B+ |
| 83-87  | B  |
| 80-82  | B- |
| 77-79  | C+ |
| 73-76  | C  |

**Credit cannot be awarded for a grade less than a C.**

**Attendance Expectations:** Because of the interactive nature of graduate classes at EMU, we believe that candidates who miss class for the equivalent of six 50-minute periods or four 75 minute periods in a three semester hour course (200 minutes for a 2-semester hour course, 100 minutes for a 1-semester hour course) have not fulfilled necessary requirements to receive an “A” in the graduate class. Grades may be lowered for absences of less time at the instructor's discretion.

**Academic Honesty:**

The responsibility to foster and guard academic integrity rests with all members of the academic community. A foundation of mutual trust is essential to the learning community. Any incidences of academic dishonesty may result in a failing grade for the work submitted and a “Record of Academic Dishonesty” filed with the M.A. Director and the provost's office.

Students are asked to meet with the professor (and other affected persons, where appropriate) to examine the effects of the dishonesty on others and to develop an accountability plan.

**Special Accommodations:**

Students with disabilities preventing them from fully demonstrating their abilities should contact the instructor personally as soon as possible to discuss any accommodations necessary to ensure full participation and facilitate equal educational opportunity. All information and documentation of the disability is confidential and will not be released without permission.

### Tentative Class Schedule for Fall 2010

| CLASS                     | TOPIC                                                                                                                                          | ASSIGNMENTS                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Class 1<br><i>Sept 2</i>  | Registration/Introductions<br>Teaching w/ Significant Mathematical Tasks                                                                       | Distribute Problem Set 1                                                                                                     |
| Class 2<br><i>Sept 9</i>  | NCTM's Process Standards<br>Place Value/Rounding                                                                                               | Read TSCM Chapters 1 & 2 (pp 39 – 55)<br><b>Class Discussion 1 due</b>                                                       |
| Class 3<br><i>Sept 16</i> | Brain-based Learning in Mathematics<br>Addition & Subtraction Algorithms                                                                       | Read TSCM Chapters 3 (pp 74-87), and 4 (pp 100-112)<br><b>Problem Set 1 due</b> , distribute Set 2                           |
| Class 4<br><i>Sept 23</i> | Components of a Balanced Math Program<br>Model Lesson Formats<br>Multiplication and Division Concepts<br>Mental Math and Computational Fluency | Read TSCM Chapter 2 (pp 56-73) & Chapter 3 (pp 88-99)<br><b>Class Discussion 2 due</b>                                       |
| Class 5<br><i>Sept 30</i> | Problem Solving Framework<br>Teaching with Word Problems<br>Solving Problems with Model Drawing                                                | Read select articles on teaching with word problems and using model drawing<br><b>Class Discussion 3 due</b>                 |
| Class 6<br><i>Oct 7</i>   | Assessment – Formative and Summative<br>Multiplication and Division Algorithms                                                                 | Read TSCM Chapter 4 (pp 113 – 130)<br><b>Problem Set 2 due</b> , distribute Set 3                                            |
| Class 7<br><i>Oct 14</i>  | Multiple Representations<br>Finding and Sharing Resources                                                                                      | <b>“Try It Out” reflection 1 due</b>                                                                                         |
| Class 8<br><i>Oct 21</i>  | Assessment - Analysis of Student Errors<br>Fraction Concepts                                                                                   | Read select articles on analysis of student errors in the math class<br>Read TSCM Chapter 5<br><b>Class Discussion 4 due</b> |
| Class 9<br><i>Oct 28</i>  | “Unpacking” Content Standards<br>Knowledge Packages<br>Fraction Computation                                                                    | Read TSCM Chapter 6<br><b>Problem Set 3 due</b> , distribute Set 4                                                           |
| Class 10<br><i>Nov 4</i>  | Differentiation in the Math Classroom (Tiered Instruction)<br>Decimal Concepts                                                                 | Read TSCM Chapter 7<br>Read select articles on struggling learners<br><b>Class Discussion 5 due</b>                          |
| Class 11<br><i>Nov 11</i> | Interventions - Diagnostic Interviews<br>Decimal Computation                                                                                   | Read select articles on struggling learners and diagnostic interviews<br><b>“Try It Out” reflection 2 due</b>                |

|                           |                                                                                                                      |                                                                                                        |
|---------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Class 12<br><i>Nov 18</i> | Interventions – specific programs                                                                                    | Read select articles on math intervention<br><b>Class Discussion 6 due</b><br><b>Problem Set 4 due</b> |
| Class 13<br><i>Dec 2</i>  | Assorted Topics:<br>Number Theory: factors, multiples, primes,<br>even/odd, divisibility tests<br>Algebraic Thinking | Read TSCM Chapter 10<br><b>Class Discussion 7 due</b>                                                  |
| Class 14<br><i>Dec 9</i>  | Differentiation and Enrichment<br>Tiered Assessment<br>Mentoring Mathematical Minds ( $M^3$ )                        | Read select articles on enrichment<br><b>“Try It Out” reflection 3 due</b>                             |
| Class 15<br><i>Dec 16</i> | Presentation of Final Projects                                                                                       | <b>Final Project due</b><br><b>Class Discussion 8 due</b>                                              |