

EDIC 591 Rational Numbers and Proportional Reasoning
Eastern Mennonite University
Master of Arts in Education
Waynesboro Public Schools
Spring 2012

Credit Hours: 3 semester hours

Instructor: Brian Nussbaum, M.A.
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Class Schedule:

Jan 25 Wed 4:45-8:45
Feb 1 Wed 4:45-8:45
Feb 8 Wed 4:45-8:45
Feb 15 Wed 4:45-8:45
**(No class Feb 22)
Feb 25 Sat 8:00-4:00

Feb 29 Wed 4:45-8:45
Mar 7 Wed 4:45-8:45
Mar 14 Wed 4:45-8:45
**(No class Mar 21)
Mar 28 Wed 4:45-8:45
plus 4 hrs online

Course Description:

This course is designed to engage participants in constructing relational understanding in the following areas:

- theoretical development of mathematics and students' learning of mathematics within the content strands of rational numbers and proportional reasoning
- development of pedagogical knowledge of rational numbers and proportional reasoning
- assessment of students' mathematical conceptions (i.e., knowledge, beliefs, attitudes, and emotions) through interviews.

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.

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.

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.

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.

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

Caring: to develop a nurturing spirit that advocates for students, encourages social and ethical responsibility, and promotes peacebuilding in diverse settings.

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

Objectives (M.A. Program Outcomes): Upon successful completion of this course, the student will be able to:

1. Demonstrate his or her professional competence, confidence and enthusiasm for teaching and learning mathematics. (S, PK, Co, L)
2. Analyze children's mathematical learning of rational numbers, in the spirit of the NCTM reform documents and state standards. (S, PK)
3. Develop teaching strategies for planning and teaching mathematics; that is, knowing how to select appropriate mathematical tasks, asking productive questions, giving useful explanations, and evaluating student work. (I, PK, Co, Ca)
4. Select and use appropriate manipulatives to connect the concrete phase of mathematics learning to the abstract, symbolic phase of learning. (PK)
5. Demonstrate knowledge of the recommendations of various members of the mathematics education community for content and curricular knowledge of school mathematics. (S, PK, L)
6. The student demonstrate a desire to, and show reflection on how he or she will take responsibility for how her or his own professional growth and contribute to the field of mathematics education. (S, I, PK)

Reference Texts and Readings:

Lamon, S. J. (2005). *Teaching fractions and ratios for understanding: Essential content knowledge and instructional strategies for teachers*. (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Fosnot, C. T. & Dolk, M. (2002). *Young mathematicians at work: Constructing fractions, decimals, and percents*. Portsmouth, NH: Heinemann.

Course Requirements:

Attendance (5%). As stated in the EMU Master of Arts in Education Handbook 20010-2011:

"Because of the interactive nature of graduate classes at EMU, we believe that students who miss class for the equivalent of 600 minutes 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." Please contact the instructor if any absence is anticipated.

Mathematical Thinking Paper (5%). At the beginning of the course you will write a paper outlining your mathematical experiences, as well as your ideas about mathematics and teaching mathematics (specifically rational numbers). [Rubric to be provide] **Paper Due: Wed 2/1**

Weekly Readings and Activities (15%). In preparation for class discussion you are expected to read assigned readings as well as complete assigned exercises (5%) from the readings. Additional outside reading on selected topics may also be expected. **Moddle discussion board participation is expected by Monday @ midnight** (5%), and class activities and discussions should reflect this preparation (5%). **Due: weekly in class**

Lesson Presentation (25%). Discover a new instructional strategy specific to rational numbers and proportional thinking. Create a 30-minute lesson to model for the class. Include a summary of the specific skills/concepts that the activity is targeting. Specific guidelines and procedures will be handed out early in the course. [Rubric to be provide] **Presentation: Sat 2/25**

Structured Interview (30%). To focus on one aspect of your instructional role as a teacher, the main purpose of the Structured Interview is to sharpen your ability to interact with children in a listening capacity. Such capacity serves the teacher in inquiring into children's mathematical thought processes and understandings. You will prepare a sequence of tasks and questions related to assessing specific conceptual and procedural knowledge, improve your questioning skills, learn to distinguish between interpreting what the child knows and teaching the child what he or she does not know, devise instructional interventions based on your interview findings, and

learn through providing and attending to feedback. Your interviews should focus on topics within the content strands of rational numbers and proportional reasoning.

Working with a partner, it is your responsibility to find ***two*** children at the same grade level to interview. (*Remember to seek written permission from the parents or teacher to conduct the interview.*) You are expected to do two interviews - the first as a “practice” or pilot interview; and a second more in-depth interview. You and your partner are to plan and organize tasks and materials for an interview with a child, conduct an interview with him or her, explicate your interpretations of the child’s conceptual and procedural knowledge in written form, and suggest ways in which the understandings gained through the interview can be utilized to enhance the child’s learning.

After conducting your first interview and reflecting with your partner*, conduct a 2nd, ***videotaped*** interview with another child (exchange roles – one partner is an observer and one partner is an interviewer). You and your partner will develop a class presentation that encompasses your learning experiences throughout the project. Specific guidelines and procedures will be handed out early in the course. [Rubric to be provide]

**You are expected to check-in with the instructor after the first interview to present your concept for the final interview*

First Check-In: Sat 2/25

Presentation: Wed 3/7

Journal Article Responses (10%). During class time we will take time to visit the EMU library to look at professional journals. You will write a reflection/response to several articles on the topic of rational numbers and proportional thinking. [Rubric to be provide] **Class time: Sat 2/25 Due: Wed 3/7**

Final Reflection Paper/Presentation (10%). At the conclusion of the course you are expected to reflect on your changed perspective for teaching mathematics. This will be presented in both a paper and a *creative* class presentation. [Rubric to be provide] **Paper & Presentation Due: Wed 3/28**

Evaluation: Students will receive one grade for all components of the course based on the following criteria and grading scale:

Grade of A. Attendance at all sessions; initiative; clear evidence of planning and organization in group tasks; careful and reflective responses to assigned readings, exercises, reflection papers & journal article responses; two projects that, in addition to including the requirements, show evidence of breadth and depth of research, thought, and preparation. Deadlines met.

Grade of B. Attendance at most class sessions; active participation in group tasks; completion and response to assigned readings, exercises, reflection papers & journal article responses; completion of two projects that include all of the requirements and show evidence of careful thought and preparation. Extra time required for completion.

Grade of C. Satisfactory completion of all requirements. Absences; little evidence of planning and organization in group tasks; and incomplete or cursory reading of assigned materials, exercises, reflection papers & journal article responses. Projects show thought and planning, but lack a polished presentation and/or incomplete analysis/reflection. Assignments turned in late.

Below C. Failure to meet expectations in the course.

Grading Scale:

95-100 pts.	= A	84-87 pts.	= B	72-76 pts.	= C
91-94 pts.	= A-	80-83 pts.	= B-		
88-90 pts.	= B+	77-79 pts.	= C+		

Academic Integrity: 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 incidents of academic dishonesty may result in a failing grade for the work submitted and a "Record of Academic Dishonesty" filed in the graduate dean'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 Statement: If a student needs course adaptations or accommodations because of a documented disability, or has emergency medical information to share, please inform the instructor of your needs.

Knowledge Base:

Teacher practitioners at the middle school and high school levels must have a conceptual understanding of proportions and rationale numbers since these are primary topics that are addressed at this stage in the curriculum progression. It is essential for teachers to have confidence in their own understanding of these topics before they can use new knowledge to enhance what they do in their classroom.

This course will pull concepts from NCTM and state standards and restructure them into new methods for conceptualizing these concepts based upon recent research. Teachers will be expected to challenge their own thinking about rational numbers and proportional thinking, analyze others' ways of thinking, and experiment with alternative methods of presenting concepts with a goal of transforming their classroom instruction.

Resources:

The following is not a comprehensive list of resources. The expertise and breadth of experience of graduate students provides considerable knowledge as well. This list is preliminary and will be supplemented by student input.

- Ecklund, L. (1994). *Fractions with tangrams*. Fresno, CA: J. Creative Teaching Associates.
- Gates, P. (Ed.). (2001). *Issues in mathematics teaching*. New York: Routledge Falmer.
- Huntley, H.E. (1970). *The divine proportion*. New York: Dover Publications, Inc.
- Hatfield, M. M., Edwards, N. T., Bitter, G. G., & Morrow, J. (2005). *Mathematics methods for elementary and middle school teachers*. (5th Ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Jencks, S.M., & Peck, D.M. (1968). *Building mental imagery in mathematics*. New York: Holt, Rinehart and Winston, Inc..
- Lamon, S. J. (2001). Presenting and Representing From Fractions to Rational Numbers. *The roles of representation in school mathematics*. 2001 Yearbook. Reston, VA. National Council of Teachers of Mathematics.
- Martin, W.G., Strutchens, M. E., Elliott, P.C. (Eds.). (2007). *The learning of mathematics*. Sixty-ninth Yearbook. Reston, VA. National Council of Teachers of Mathematics.
- Litwiller, B. & Bright, G. (Eds.). (2002). *Making sense of fractions, ratios and proportions*. 2002 Yearbook. Reston, VA. National Council of Teachers of Mathematics.
- Owens, D. T. (Ed.). (1993). *Research ideas for the classroom: Middle grades mathematics*. New York: MacMillan Publishing Company.
- Robbins, P. R., Hauge, S. K. (1999). *Word problems with decimals, proportions and percents*. (Revised). Portland, ME: J. Weston Walch.
- Robbins, P. R., Hauge, S. K. (1999). *Word problems with fractions*. (Revised). Portland, ME: J. Weston Walch.
- Sgroi, L.S. (2001). *Teaching elementary and middle school mathematics: Raising the standards*. Belmont, CA: Wadsworth, Thompson Learning.

TENTATIVE Sessions Outline:

Online submissions are 'due' by Monday Midnight. Written exercises and presentations are due in class

W 1/25

Introductions
Syllabus
Moodle
What is/are fractions proportional thinking,
SOL's related to the topic
Mathematical Thinking Paper introduction
Resource discussion

HW: Moodle discussion board questions*
Mathematical Thinking Paper
Resource scavenger hunt (googledoc)

W 2/1

Mathematical Thinking Paper Due

Discuss resource list
GCF/LCM
Lesson Presentation Introduction
Vygotsky and ZPD

HW: Lamon 1-3 *
(Lesson Presentation)

W 2/8

Introducing Interview Project
Pattern Blocks
Ratio vs Fraction
Discuss readings/activities

HW: Lamon 4-6*
(Lesson Presentation)
(Interview Project)

W 2/15

Khan approach
Ordering rational numbers
Measurement (tricks with 1/8ths)
Die Cut manipulatives
Discuss readings/activities

HW: Don't Lecture Me podcast*
Lamon 7-8*
Fosnot 1-2*

(No Class W 2/22)

*Make sure Lesson Presentations
and
First Structured Interview are complete*

Sat 2/25 @ EMU

Lesson Presentations Day

Don't Lecture Me discussion
Lesson Presentations
Journal Research
Structured Interview check-in
Discuss readings/activities
Dan Meyer video

HW: Reinhart article*
Lamon 9-11*
Fosnot 3-4*
(Interview Project)
(Journal Research)

W 2/29

Horizontal, Vertical & Cross Product thinking
NOT Proportional Thinking
History: Pythagoras, Unit Fractions...
Discuss readings/activities

HW: Lamon 12-14*
Fosnot 5*
(Interview Project)
(Journal Research)

W 3/7

Interview Presentation Day

Journal Research Due

Interview Presentations

Discuss readings/activities

HW: Lamon 15-17*

Fosnot 6-7*

W 3/14

Ratio, Rate, Unit Rate

Estimation vs Calculations

SALE! & Restaurant projects

Algorithm vs Understanding

Final Reflections P/P introduction

Discuss readings/activities

Wolfram video

HW: Lamon 18*

Fosnot 8-9*

(No Class W 3/21)

*Make sure Final Reflection Paper/Presentation
is ready*

W 3/28

Final Reflection Paper Due / Presentation Day

Final Reflection Presentations

Discuss readings/activities

Sir Robins Video

*Indicates Moodle Discussion Board questions

Writing Standards –Graduate Level (Grid Version)

Criteria	A excellent	B minimal expectations	C below expectations	Comments
Content (quality of the information/ideas and sources/details used to support them)	- shows clarity of purpose - shows depth of content - applies insight and represents original thinking - demonstrates quality and breadth of resources	- shows clarity of purpose - shows substantial information and sufficient support - almost always represents original thinking - uses quality resources	- shows clarity of purpose - lacks depth of content and may depend on generalities or the commonplace - represents little original thinking - uses mostly quality resources	
Structure (logical order or sequence of the writing)	- is coherent and logically developed - uses very effective transitions	- is coherent and logically developed - uses smooth transitions	- is coherent and logically (but not fully) developed - uses some awkward transitions	
Style (appropriate attention to audience: effective word choice, sentence variety, voice; appropriate level of formality for academic writing vs. informal text messages and email)	- is concise, eloquent, and rhetorically effective - composes varied sentence structure	- displays concern for careful expression - composes some varied sentence structure	- displays some personality but lacks imagination and may be stilted - composes little varied sentence structure - frequently uses jargon and clichés	
Conventions (adherence to grammar rules: usage, mechanics)	- composes well-constructed sentences - makes virtually no errors in grammar and spelling - makes accurate word choices	- almost always composes well-constructed sentences - makes minimal errors in grammar and spelling - makes accurate word choices	- usually has well-constructed sentences - makes several errors - makes word choices that distract the reader	
Source Integrity (appropriate acknowledgment of sources used in research)	- cites sources for all quotations - composes credible paraphrases, cited correctly - includes reference page - makes virtually no errors in documentation style	- cites sources for all quotations - composes credible paraphrases, usually cited correctly - includes reference page - makes minimal errors in documentation style	- cites sources for all quotations - composes mostly credible paraphrases, sometimes cited correctly - includes reference page - makes several errors in documentation style	
The weighting of each of the five areas is dependent on the specific written assignment and the teacher's preference. Plagiarism occurs when a person presents as one's own "someone else's language, ideas, or other original (not common-knowledge) material without acknowledging its source" (adapted from Council of Writing Program Administrators).				Grade

Updated 2009