

Augusta State University
College of Education
Department of Teacher Education
Fall 2009

Course: EDTD 6141A: Research in Mathematics Education
Time: October 21 – December 10, W: 5:30 - 8:45, UH 356
Instructor: Dr. Emam Hoosain **Office:** UH 369
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Office Hours: TR: 11:15 –12:00; 1 – 4; and by appointment.

Required Text:

1. National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.
2. ***Livetext membership

Other useful Publications:

1. National Council of Teachers of Mathematics. (1989). *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: NCTM.
2. National Council of Teachers of Mathematics. (1991). *Professional Standards for Teaching Mathematics*. Reston, VA: NCTM.
3. National Council of Teachers of Mathematics. (1995). *Assessment Standards for School Mathematics*. Reston, VA: NCTM.
4. National Council of Teachers of Mathematics. (2007). *The Second Handbook of Research on Mathematics Teaching and Learning*. Reston, VA: NCTM.
5. Grouws, D. A. (Ed.). (1992). *Handbook of Research in Mathematics Teaching and Learning*. NY: Macmillan Publishing Co.
6. Senk, S. L. & Thompson, D. R. (Eds.). (2003). *Standards-Based School Mathematics Curricula: What Are They? What Do Students Learn?* NJ: Lawrence Erlbaum Associates.
7. Journals: *Teaching Children Mathematics; Mathematics Teaching in the Middle School; Mathematics Teacher; Journal for Research in Mathematics Education, Educational Studies in Mathematics, Focus on Learning Problems in Mathematics*.
8. NCTM's Yearbooks.

Supplementary Readings will be assigned or provided from time to time.

Syllabus

Course Description:

The course examines current research in mathematics education and issues related to such research. These researches are drawn from published literature and relate to actual classroom practice. *Prerequisites:* Admission to Graduate Program and EDTD 6010.

Course Goal:

To provide:

- (a) a theoretical framework for professional practice;
- (b) opportunities for students to critique research in mathematics education;

- (c) a context for students to experiment with ideas for the teaching of mathematics;
- (d) opportunities for students to discuss controversial issues in mathematics education;

Specific Objectives:

1. The students will demonstrate knowledge of:
 - (a) NCTM's Standards documents;
 - (b) recent results of research in mathematics education;
2. They will:
 - (a) critique research articles and reports;
 - (b) discuss some big ideas in the teaching of mathematics;
 - (c) orally present findings from their readings and investigation;
 - (d) assess student achievement;
 - (e) conduct a research and write a report; within the context of NCTM's recommendations.

Conceptual Framework: Understanding for Teaching, Teaching for Understanding

The preparation of educators is the most critical of all professions---Without educators there are no other professions. The professional educator is the key element in the learning process. Building on the key elements of the professional educator, the Conceptual Framework of the unit of Augusta State University consists of a vision and mission with an overarching theme to produce **prepared, able, and responsive** professionals to teach diverse learners. This vision and mission is a shared responsibility between campus colleagues, public school practitioners, and involved community agencies requiring the partnership of the entire education unit including the College of Education, the College of Arts and Sciences, and the local community educational system and the Professional Development School Network.

Conceptual Framework: Vision

Prepare school professionals who transform P-12 learners into thinking, productive citizens.

Conceptual Framework: Mission

Educating prospective school professionals to be knowledgeable, effective, and ethical.

Element: Prepared

Dispositions: Critical thinkers about the process of teaching, learning, and assessment. *The disposition to think critically is about the process of teaching and learning is tendency to question that which may be assumed. It involves probing, digging deeper, establishing quality and using dialogue as a means to work toward that end. It may be deconstructive in its nature and seek to unpack the black and white nature of statements, and simplistic nature of responses, procedures or assignments. Well prepared candidates:*

- Demonstrate strong content and pedagogical preparation in their respective subject area or professional field. (NBTS 2)
- Use self assessment and analysis to form the basis for collaboration with colleagues and the development of a desire to be a lifelong learner. (NBTS 4)

- Participate in graduate study to extend and refine the knowledge base of educators to build expertise. (NBTS 5)
- Possess an understanding of the central concepts, tools of inquiry, and structures of the discipline(s) or their professional field of study and be able to create learning experiences that enable all students to learn. (CFP 1) (NBTS 2)
- Understand how students learn and develop (intellectually, socially, and individually) and be able to provide developmentally appropriate learning opportunities and support for these opportunities. (CFP 2)
- Demonstrate a knowledge of how to implement effective verbal, nonverbal, and information and utilize technology techniques to foster active inquiry, collaboration, and supportive interaction in educational settings. (CFP 6)

Element: Able

Dispositions: Empathetic, responsive, enthusiastic, inclusive, and reflective in relations with students, parents and peers. *This disposition is characterized by the propensity to view learning as encompassing a variety of approaches to meet individual learner needs focusing on differentiating instruction. The education professional sees multiple ways of framing learning, solving problems, approaching instruction, and providing examples. The professional is disposed to act as a guide and think in an inquiry-oriented mode and views facts and knowledge as a means to build toward understanding. The professional is disposed to focus on goal setting and taking next steps toward improvement. Student competence is assumed and all students are pushed toward high levels of achievement. High quality educator preparation produces stronger candidates and thus more effective classroom teachers, counselors, and administrators who can:*

- Understand, use and support a variety of instructional strategies to encourage the learner's development of critical and creative thinking, problem solving, and performance skills. (CFP 4)
- Create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation for all learners. (CFP 5)
- Plan, guide, and support instruction based upon knowledge of subject matter, the learners, the community, and curriculum goals. (CFP 7)
- Understand and use authentic assessment to evaluate and ensure the continuous intellectual, social, and physical development of the learner. (CFP 8) (NBTS 3)

Element: Responsive

Dispositions: Creative, challenging, and flexible in teaching/professional practices. *The education professional is disposed to be responsive to students' developmental needs and characteristics and exhibits responsiveness to students as diverse individuals including their personal lives and experiences. Learning is viewed as relevant and connected to students' lives. Families and parents are embraced as partners in the learning process and community is valued as an asset to learning. Peers are treated as partners and resources in a collaborative manner. This disposition is a thinking-based orientation that is reflective in many dimensions in terms of needs and actions of the learner, their developmental characteristics, their cultural background and experiences, their levels of understanding, student questions, student work samples, the learning context and*

expectations of the profession and society as a whole. All partners including students, parents, and colleagues are valued as providing input into important decisions in the learning process. Candidates who are responsive demonstrate:

- A respect for the dignity of all persons. All children can learn and have the right to an opportunity to do so.
- Preparation in the subject area(s) to be taught or the professional field of study must be accompanied by the skill and dispositions to translate knowledge into creating and supporting meaningful experiences for diverse learners
- Ability to teach and work in authentic settings with diverse populations of learners
- Understanding of how students differ in their approaches to learning and demonstrate the commitment for meeting their educational needs in fair, caring, nondiscriminatory, and equitable manners. (CFP 3)
- Ability to be a reflective practitioner who continually evaluates the effects of his/her choices and actions on others (students, parents, and other professionals in the learning community) and actively seeks the opportunity to grow professionally (CFP 9) (NBTS 4)
- Fostering of relationships with school colleagues, parents, and agencies in the larger community to support the learning and well-being of all students. (CFP 10) (NBTS 5)

National Board Standards Addressed:

1. Educators are committed to students and their learning.
2. Educators know the subjects they teach and how to teach those subjects to students.
3. Educators are responsible for managing and monitoring student learning.
4. Educators think systematically about their practice and learn from experience.
5. Educators are members of learning communities.

Course Outline:

Tentative Schedule

Week 1: Introductions and Overview of Course; review of definitions of research, the research process, types of research and data analysis.

Readings: *From a research text.*

Week 2: An overview of the NCTM Standards; Approaches to Teaching Mathematics; Current Research Topics in Mathematics Education; e.g., Induction, TIMSS and NAEP.

Readings: *Miseducation of America's Youths; The Canary in the Mine; Understanding and Improving Classroom Mathematics Instruction; Solving the Mystery of Teaching Mathematics. Mathematics and the Learning Cycle: How the Brain Works as it Learns Mathematics.*

Improving the Planning and Teaching of Mathematics by Reflecting on Research.

- Week 3:** Cognitively Guided Instruction (CGI) and Problem Solving;
Readings: *Problem-Solving Strategies of First Graders; Teaching Problem Solving in Mathematics; Cognitively Guided Instruction; Teaching Without Telling.*
- Week 4:** Standards-based/non-Standards-based curriculum.
Readings: *The Impact of Two Standards-Based Mathematics Curricula on Student Achievement in Massachusetts; Assessing the Impact of Standards-Based Middle Grades Mathematics Curriculum Materials on Student Achievement; Curricular Controversy in the Math Wars; Standards-Based Curriculum Materials; Implementing Standards. Standards-based Mathematics Curricula and Middle-Grades Students' Performance on Standardized Achievement Tests; The Impact of Middle-Grades Mathematics Curricula and the Classroom Learning Environment on Student Achievement; Standards-based Mathematics Curricula and Secondary Students' Performance on Standardized Achievement Tests.*
- Week 5:** The Place of Standard Algorithms in the Classroom; the van Hiele Model for Geometry.
Readings: Articles by Kamii; *Van Hiele Levels of Geometrical Thought Revisited; The Van Hiele Model of the Development of Geometric Thought.*
- Week 6:** Resources for the teaching of mathematics; e.g., Use of Manipulatives and Technology.
Readings: *Effects of Manipulative Materials in Mathematics Instruction; I did it my Way; A Meta-Analysis of the Effects of Calculators on Students' Achievement and Attitude Levels in Precollege Mathematics Classes.*
- Week 7:** Monitoring student progress and evaluating achievement; Error Pattern Analysis;
Readings: *Classroom Assessment; Ashlock's book.*
- Week 8:** Writing in Mathematics.
Readings: *Examining the Effects of Writing on Conceptual and Procedural Knowledge in Calculus; Writing about the Problem-Solving Process to Improve Problem-Solving Performance.*

Evaluation

Course Grading Procedure:

1. Class Participation and Attendance	20 pts.
2. Applications	130 pts.
Article Summary (<i>Writing about the Problem-Solving process to improve Problem-Solving Performance.</i>)	
[Due no later than 11/11]	30 pts.
**Research Project (40 points) and Presentation (10 points)	
(See below.) [Due no later than 12/02]	50 pts.
**Presentation of article summary, other than	
<i>Writing about the Problem-Solving . . . Performance.</i>	10 pts.
Impromptu Assignments and Quizzes	30 pts.

**Must not have been done for another class.

Note: Some dates are TBA. More specific directions about these assignments will be given in class.

Note: Students are required to attend classes regularly and punctually. If a student is absent for more than **a total of three hours**, he/she may be asked to withdraw from the class. Unsatisfactory attendance of classes and participation in class activities will adversely affect your grade. It is the responsibility of the student to complete any work assigned during his/her absence. **Points will be deducted for all late papers - 10% for every day it is late.** All assignments should be typed, double-spaced and proofread before submission. Final versions (not drafts) of assignments must be submitted through Livetext. Points will be deducted for grammatical and other errors in written assignments. You are advised to complete the readings and assignments, meet regularly with other students to discuss issues, and see the Instructor if you have any problems. Children and other relations are not allowed in class except with the Instructor's prior permission. Food and drink (except that in stomach) are not allowed in class. Turn off your cell phone, please. Occasionally it may be necessary for the Instructor to communicate with students via Pipeline email. Therefore, students are strongly advised to check their campus email regularly. The Instructor may also use the 'Announcements' facility on Livetext to communicate with students. Please refrain from submitting assignments as email attachments. Students with disabilities need to contact ASU's Office of Disability at (706) 737-1469. Students are strongly advised to read the section on "Academic Honesty" in the University Catalog.

Final grading will be as follows:

- A: 90+ - 100**
- B: 80+ - 90**
- C: 70+ - 80**
- D: 60+ - 70**
- F: 00 - 60**

Research Project: Conduct a research/investigation with one student or a group of students and write a report under the following four headings: a. **Introduction** – state clearly the problem you are addressing and give a justification (its importance, relevance, and significance in current reforms [state and national] in mathematics education); indicate references to the literature; b. **Procedure** – state the purpose of your investigation explicitly; state also the research questions or objectives; and describe in detail what you did; describe the subject(s) with whom you did this investigation; describe any data collection procedures and state the kind of data you collected (qualitative and quantitative); c. **Analysis of Data and Findings** – explain how you analyzed the data and state the findings; use descriptive and other statistics and any appropriate statistical procedures; analyze students’ work; d. **Summary, Conclusion, Discussion, Recommendation, and Self-Reflection:** **Summary** (summarize what you did; that is summarize a, b, c), **Conclusion** (state a general conclusion emanating from your analysis and interpret it in reference to what you investigated), **Discussion** (state the implications [the impact on decision-making] of your findings), **Recommendation** (resulting from your findings), **and Self-Reflection** (evaluate the impact that this experience had on you and state any changes you will make if you have to redo it).

The report should be typed, double-spaced, font size 12 (Times), with margins between 1 inch and one and a half inches wide. Include the headings in the report. Points will be deducted for grammatical and other errors (1 point = 4 errors). The final report must be submitted through Livetext. The draft should be submitted about a week before the deadline so that the Instructor will have enough time to read it and discuss it with you. The draft and discussion are worth 10 points.