Mathematics Teacher Leadership Center Master's Program
Teaching Geometry

UNC COURSE INFORMATION

Course Number-Section: MED 543-970
Location: Blackboard online system
Time: 7:00–8:00 (M) and hours arranged
Virtual Office Hrs: 4:00–5:00 (M)
Semester: Spring 2010

INSTRUCTOR INFORMATION

Instructor: Rob Powers, Ed.D.
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COURSE SPECIFICATIONS

Credits: 2 Semester Credits
As a two-credit master's level course, you should expect to spend between 6-8 hours per week on this course.

Course Description:
The course focuses on current research and practices of teaching, learning, and assessing geometry and other issues related to the geometry curriculum, such as measurement. The course also addresses the processes of reasoning and proof as they pertain to secondary geometry.

Required Texts:
National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM. (Available for free for 90 days at standards.nctm.org.)

Recommended Texts:
Albrecht, M. R., Burke, M. J., Ellis, Jr., W., Kennedy, D., & Maletsky, E. M. (2004). *Navigating through Measurement in Grades 9–12.* Reston, VA: NCTM.
Bright, G. W., Jordan, P. L., Malloy, C., & Watanabe, T. (2005). *Navigating through Measurement in Grades 6–8.* Reston, VA: NCTM.
Day, R., Kelley, P., Krussel, L., Lott, J.W., & and Hirstein, J. (2002). *Navigating through Geometry in grades 9–12.* Reston, VA: NCTM.
Picciotto, H. (1999). *Geometry labs: Activities for grades 8–11.* Emeryville, CA: Key Curriculum Press.
Pugalee, D. K., Frykholm, J., Johnson, A., Slovin, H., Malloy, C., & Preston, R. (2002). *Navigating through geometry in grades 6–8.* Reston, VA: NCTM.
Wiggins, G., & McTighe, J. (2005). *Understanding by design* (Expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Technical Requirements:
1. High speed internet access either at your home or school
2. Headset with microphone and speakers and Webcam for Webinars
3. Writing tablet for written interaction on the white board
4. Access to Blackboard (bb.unco.edu) for synchronous and asynchronous sessions
5. Word Processor (prefer *Microsoft Word*) and *Acrobat Reader* (download from www.adobe.com/products/acrobat/readstep2.html)
6. Geometer's Sketchpad (www.keypress.com) OR GeoGebra (www.geogebra.org)

Course Goals:

- To examine state and national recommendations for teaching, learning, and assessing geometry and measurement in secondary schools.
- To examine national recommendations for teaching and learning reasoning and proof in secondary schools.
- To examine geometry content and geometry pedagogical content knowledge in light of current research and reform practices.
- To provide opportunity to examine and reflect on personal practices of teaching geometry and measurement as well as reasoning and proof.
- To develop materials appropriate for professional growth and for use in classrooms in the teaching of secondary geometry.

Essential Questions of the Course:

- How do secondary students really learn geometry?
- What geometry should secondary students really learn?
- How do we as teachers reconcile the state and national recommendations for teaching, learning and assessing geometry and measurements in secondary school with the realities we face every day in the classroom?
- How do current research and reform practices inform teaching, learning, and assessing geometry and measurement in secondary schools?

Math TLC Course Elements:

- The Math TLC is committed to developing courses in the master's program that will challenge the Euro-centric view of mathematics in that each instructor will devote at least 10% of course time to exploring the historical and cultural nature of "modern" mathematics.
- The Math TLC is committed to developing courses in the master's program that includes activities that engage teachers in collectively analyzing, exploring and understanding culturally responsive mathematics pedagogy.
- The Math TLC is committed to developing a vision of mathematics based on shared community standards that begin through research-based understandings and nationally recognized standards of mathematics education.

Bibliography:

Burger, W. F., & Culpeper, B. (1993). Restructuring geometry. In P. S. Wilson (Ed.), *Research ideas for the classroom: High school mathematics* (pp. 140–154). New York: MacMillan.

Clements, D. H., & Battista, M. T. (1992). Geometry and spatial reasoning. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 420–464). New York: MacMillan.

Fuys, D., Geddes, D., and Tischler, R. (1988). The van Hiele model of thinking in geometry among adolescents. *Journal for Research in Mathematics Education Monograph, 3*.

O'Daffer, P. G., & Thornquist, B. A. (1993). Critical thinking, mathematical reasoning, and proof. In P. S. Wilson (Ed.), *Research ideas for the classroom: High school mathematics* (pp. 39–56). New York: MacMillan.

Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development.* New York: Teachers College Press.

EVALUATION

Weekly Webinars:
Each week, we will gather as a group of scholars to discuss issues relevant to the teaching and learning of secondary geometry and reasoning and proof. The one-hour webinars will be at 7:00 PM on Monday nights. It is expected that you attend all scheduled webinars. Missing more than 2 sessions will result in a reduction of your final grade assignment.

Weekly Assignments:
Assignments will be posted regularly in the Assignments section on Blackboard. You are expected to check the course site at least weekly basis for these assignments. Weekly assignments include specific readings (e.g., professional articles), writing tasks (e.g., reflections on teaching), and activities (e.g., reform-based tasks) and will include some outcome used in evaluation. These assignments will be individual and collaborative.

Lesson Experiments:
A course goal is to examine your own instruction. We will use lesson experiment, a small scale action research whose focus varies from one activity to a collection of lessons, to guide this examination. The expectation for these tasks is to decide on a specific lesson objective, design a way to collect reliable evidence of that objective and how you plan to teach the information, carry out the instruction and collect the information, then analyze the student work to determine the effectiveness of the instruction. If you are not teaching a geometry class, then it is expected that the focus of the lesson experiments will be on reasoning and proof in your class.

Research-to-Practice Paper:
A course goal is to examine geometry content and geometry pedagogical content knowledge in light of current research and reform practices. In the research-to-practice paper, you will search the professional literature and investigate a relevant issue involving the teaching of geometry and report on insights into the issues. The intent of the research-to-practice paper is for you to learn more about current trends in mathematics education concerning geometry to support your development as a practitioner and as a teacher researcher.

Geometry Project:
A course goal is to provide opportunity to develop materials appropriate for professional growth and practical use in geometry. As a class, we will participate in the development of a resource for secondary geometry teachers that will promote student-centered, problem-based instruction and assessment. The project will be an artifact of the course that will be publically available for reference through the MathTLC Website.

Grading allotment:

- Weekly Assignments 15%
- Lesson Experiments
  - Activity LE.....10%
  - Full scale LE 20%
- Research-to-Practice Paper 25%
- Geometry Project 30%

Grading Rubric:
The following scale is used to evaluate all materials submitted for evaluation:

4.0 – Excellent work. (A)
3.7 – Mostly excellent work. Minor improvements needed. (A^-)
3.3 – Very Strong work. Needs more than one minor improvement. (B^+)
3.0 – Strong work. Some aspects need further development. (B)
2.7 – Developing. Many aspects need further development. (B^-)
2.0 – Marginal. Developing competence, but flawed in significant ways. - (C)
1.0 – Very weak. All aspects need attention. (D)
0.0 – Inadequate. (F)

Excellent work:

- Addresses the prompt clearly and responds effectively to all aspects of the task
- Explores the issues thoughtfully and in depth
- Is coherently organized, with ideas supported by apt reasons and well-chosen examples
- Has an effective, fluent style marked by syntactic variety and a clear command of language
- Is generally free from errors in mechanics, usage, and sentence structure
- Uses APA style effectively to document sources
- Is mathematically correct
- Is completed on time

Final grade assignment:
Final scores are determined by taking the average score by category (summing up the scores and dividing by the total number of tasks) and then calculating a weighted average based on the grading allotment to produce a score between 0 and 4. Final grades are assigned as follows:

A: 3.3 – 4.0
B: 2.3 – 3.3
C: 1.3 – 2.3
D: 0.3 – 1.3
F: 0.0 – 0.3

PROFESSIONAL CONDUCT

Disability Support Services:
Any student requesting disability accommodation for this class must inform the instructor giving appropriate notice. Students are encouraged to contact Disability Support Services at (970) 351-2289 to certify documentation of disability and to ensure appropriate accommodations are implemented in a timely manner.

Honor Code:
All members of the University of Northern Colorado community are entrusted with the responsibility to uphold and promote five fundamental values: *Honesty, Trust, Respect, Fairness,* and *Responsibility*. These core elements foster an atmosphere, inside and outside of the classroom, which serves as a foundation and guides the UNC community's academic, professional, and personal growth. Endorsement of these core elements by students, faculty, staff, administration, and trustees strengthens the integrity and value of our academic climate.

University Policies:
UNC's policies and recommendations for academic misconduct will be followed. For additional information, please see the Dean of Student's website, Student *Handbook* (http://www.unco.edu/dos/handbook/index.html)

TENTATIVE SCHEDULE

Week	Day	Topics of Class Session/Assignments Due
Week 1	January 11, 2010	Principles and Standards
		Teachers will develop an artifact summarizing and comparing on the NCTM Geometry, Measurement, and Reasoning & Proof Standards with state standards.
Week 2	January 18, 2010	van Hiele Theory of Geometric Thinking ***(no Webinar)***
		Teachers will read excerpts from Fuys, Geddes and Tischler (1988) and Van de Walle (2001) on the van Hiele model. Teachers will identify two activities applicable to each van Hiele level and align them with national and state standards.
Week 3	January 25, 2010	van Hiele Model of Teaching
		Teachers will outline the five phases for teaching an activity with the goal to increase students' level of geometric thinking.
Week 4	February 1, 2010	Assessments in Geometry
		Teachers will identify ways to gather information about students' geometric thinking or reasoning ability
Week 5	February 8, 2010	Lesson Experiments
		Teachers will identify an objective that fosters geometric thinking or reasoning ability, a way to measure that objective, and an activity that is aligned to that objective.
Week 6	February 15, 2010	Linking Research with Practice
		Teachers will independently find at least four resources on a topic relevant to teaching, learning, and/or assessment of geometry.
Week 7	February 22, 2010	Investigating Geometry in Cultures **Activity Lesson Experiment is due**
		Teachers will find at least one example of geometry in a non-European culture.
Week 8	March 1, 2010	Investigating Culture in Geometry
		Teachers will find at least on example of a non-European culture in geometry.
Week 9	March 8, 2010	Culturally Responsive Pedagogy in Geometry Classrooms **Research-to-Practice Paper is due**
		Teachers will determine at least one way they can be more culturally responsive in their own teaching practice.
	March 13-21, 2010	*Spring Break*

Week	Day	Topics of Class Session/Assignments Due
Week 10	March 22, 2010	Teaching Geometry in the 21st Century
		Teachers will find at least one example of a geometry task that reflects a geometric problem in modern times.
Week 11	March 29, 2010	Geometric Topics: Proofs **Activities for Geometry Project are due**
		Teachers will work on the Lesson Experiment.
Week 12	April 5, 2010	Geometric Topics: Taxicab Geometry
		Teachers will work on the Lesson Experiment.
Week 13	April 12, 2010	Geometric Topics: Constructions **Lesson Experiment is due**
		Teachers will work on the Geometry Resource.
Week 14	April 19, 2010	Geometric Topics: Measurement **Activities for Geometry Project are due (if necessary)**
		Teachers will work on the Geometry Resource.
Week 15	April 26, 2010	Geometric Topics: Similarity
		Teachers will work on the Geometry Resource.
Finals Week	May 3, 2010	**Geometry Project is due**