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C&I 301.01: Teaching Mathematics in the Middle and Secondary School

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The University of
Montana

**Teaching Mathematics in the Middle
and Secondary School**
C&I 430.01 and C&I 301/302
Autumn 2004
Monday & Wednesday 8 - 9 AM
Tuesday & Thursday 8 -11 AM
ED 112/113

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Thursday, 1:10 PM – 3:00 PM and additional times by appointment.

Course Description

This course will focus on the teaching/learning process, how it applies to mathematics, and your reasons for becoming a teacher. The aim is for you to start developing a personal philosophy towards teaching and learning in a mathematics classroom. To this end, time will be provided for discussing and questioning your own and other's beliefs, developing and practicing teaching techniques, and sharing your concerns.

There will be a variety of activities, assignments, and reading toward this goal. These will be organized around the themes of mathematical tasks, discourse, learning environments, and analysis of the learning/teaching process.

Because this course includes a field experience component (C&I 301/302), there are opportunities for you to observe, experiment with, and discuss a variety of curriculum models and teaching techniques. The focus throughout the course will be on combining theory with practice.

Course Objectives:

Following this course, you should be able to:

- Identify the unifying “big ideas” in secondary school mathematics;
- Design a range of effective mathematics lessons while considering interdisciplinary issues;
- Solve problems, communicate mathematically, reason mathematically, and make connections across and within various mathematics topics;
- Develop a variety of assessment strategies for a middle or high school mathematics classroom;
- Explore and analyze appropriate instructional practices for teaching mathematics in the middle and high schools;
- Use appropriate technology including graphics calculators, computers including symbolic manipulators, and manipulatives to assist the learning/teaching of mathematics;
- Discuss classroom management concerns and approaches to minimizing time spent on discipline;

- Identify diversity issues and address these in applications and approaches to mathematics content; and
- Recognize the importance of professional growth in the teaching/learning of secondary mathematics.

Course Requirements

I. Texts and Materials

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.

Systemic Initiative For Montana Mathematics & Science. (1993). *The SIMMS Project, Level 1 Volumes 1&3: Field Test*. Missoula, MT: Montana Council of Teachers of Mathematics.

Systemic Initiative For Montana Mathematics & Science. (1994). *The SIMMS Project, Level 2 Volumes 1-3: Field Test*. Missoula, MT: Montana Council of Teachers of Mathematics.

Graphics calculator (Calculators will be required on and after September 7)
(If you don't have one already, consider the TI-92+, TI-89, TI-84+ or Voyage 200)

II. Group Presentation

Each group of two should plan to present one lesson/inquiry mutually chosen from the list below that can be completed in a class period (50 minute maximum):

Algebra	Patterns
Conceptual Underpinnings of Calculus	Probability
Discrete Mathematics	Spatial Sense
Functions	Statistics
Geometry	Trigonometry
Mathematical Structure	Variable
Measurement	

III. Readings

Articles and book sections will be assigned each week. You may choose to react to these readings in your journal. The following are some suggested readings:

Ball, D. L. (1991). What's all this talk about discourse? *Arithmetic Teacher*, 39(3), 44-48.

Beane, J. A. (1995). Curriculum integration and the disciplines of knowledge. *Phi Delta Kappan*. 76(8), 616-622.

Blais, D. M. (1988). Constructivism—a theoretical revolution for algebra. *Mathematics Teacher*, 81(8), 624-631.

Chambers, D. L. (1993). Integrating assessment and instruction. In N. L. Webb & A. F. Coxford (Eds.), *Assessment in the mathematics classroom - 1993 Yearbook* (pp. 17-25). Reston, VA: NCTM.

- Chappell, M. F., & Strutchens, M. E. (2001). Creating connections: Promoting algebraic thinking with concrete models. *Mathematics Teaching In The Middle School*, 7(1), 20-25.
- Clements, D. H. & Battista, M. T. (1990). Constructivist learning and teaching. *Arithmetic Teacher*, 38(1), 34-35.
- Davidson, N. (1990). Small-group cooperative learning in mathematics. In T. J. Cooney & C. R. Hirsch (Eds.), *Teaching and learning mathematics in the 1990s - 1990 Yearbook* (pp. 52-61). Reston, VA: NCTM.
- Eggleton, P. J., & Moldavan, C. C. (2001). The value of mistakes. *Mathematics Teaching In The Middle School*, 7(1), 42-47.
- Ford, R. (2004). Discovering and exploring Mandelbrot set points with a graphing calculator. *Mathematics Teacher*, 98(1), 38-46.
- Gerver, R. (1999). Mathematics journal articles: Anchors for the guided development and practice of reasoning skills. In Stiff, L.V. and F. R. Curcio (Eds.), *Developing mathematical reasoning in Grades K-12: 1999 Yearbook*. (pp.198-206). Reston, VA: NCTM.
- Goos, M. (2004). Learning mathematics in a classroom community of inquiry. *Journal for Research in Mathematics Education*, 35(4), 258-291.
- Hembree, R. & Dessart, D. J. (1992). Research on calculators in mathematics education. In J. T. Fey & C. R. Hirsch (Eds.), *Calculators in mathematics education - 1992 Yearbook* (pp. 23-32). Reston, VA: NCTM.
- House, P. A., Wallace, M. L., & Johnson, M. A. (1983). Problem solving as a focus: How? When? Whose responsibility? In G. Shufelt & J. R. Smart (Eds.), *The agenda in action - 1983 Yearbook* (p. 9-19). Reston, VA: NCTM.
- Kanold, T. D. (1990). Effective mathematics teaching: One perspective. In T. J. Cooney & C. R. Hirsch (Eds.), *Teaching and learning mathematics in the 1990s - 1990 Yearbook* (pp. 76-81). Reston, VA: NCTM.
- Kloosterman, P. & Gainey, P. H. (1993). Students' thinking: Middle grades mathematics. In D. T. Owens & S. Wagner (Eds.), *Research ideas for the classroom: Middle grades mathematics* (pp. 3-21). New York: Macmillan.
- Koehler, M. S. & Prior, M. (1993). Classroom interactions: The heartbeat of the teaching/learning process. In D. T. Owens & S. Wagner (Eds.), *Research ideas for the classroom: Middle grades mathematics* (pp. 280-298). New York: Macmillan.
- Lankford, N. K. (1993). Teacher as researcher: What does it really mean? In P. S. Wilson & S. Wagner (Eds.), *Research ideas for the classroom: High school mathematics* (pp. 279-289). New York: Macmillan.

- Leitzew, A.R., & Kitt, N.A. (2000). Using homemade algebra tiles to develop algebra and prealgebra concepts. *Mathematics Teacher* 93(6), 462-466, 520.
- Lester, F. K., & Kroll, D. L. (1991). Evaluation: A new vision. *Mathematics Teacher*, 84(4), 276-284.
- Lott, J.W., & Souhrada, T.A. (2000). As the century unfolds: A perspective on secondary school mathematics content. In Burke, M.J. and F. R. Curcio (Eds.), *Learning mathematics for a new century. 2000 Yearbook*. (pp. 96-111). Reston, VA: NCTM
- Miller, L. D. (1992). Teacher benefits from using impromptu writing prompts in algebra classes. *Journal for Research in Mathematics Education*, 23(4), 329-340.
- Sherin, M.G., Mendez, E.P., & Louis, D.A. (2000). Talking about math talk. In Burke, M.J. and F. R. Curcio (Eds.), *Learning mathematics for a new century. 2000 Yearbook*. (pp.188-196). Reston, VA: NCTM.
- Steen, L. A. (1990). Mathematics for all Americans. In T. J. Cooney & C. R. Hirsch (Eds.), *Teaching and learning mathematics in the 1990s - 1990 Yearbook* (pp. 130-134). Reston, VA: NCTM.
- Ward, C. D. (2001). Under construction: On becoming a constructivist in view of the Standards. *Mathematics Teacher*, 94(2), 94-96.
- Watson, J. M., & Shaughnessy, J. M. (2004). Proportional reasoning: Lessons from research in data and chance. *Mathematics Teaching in the Middle School*, 10(2), 104-109.
- Webb, N. L. (1993). Assessment for the mathematics classroom. In N. L. Webb & A. F. Coxford (Eds.), *Assessment in the mathematics classroom - 1993 Yearbook* (pp. 1-6). Reston VA: NCTM.

IV. Assessments / Assignments

Writing: Write your own journal article about one of the big ideas in secondary mathematics education. Read other articles to help guide your writing. Maximum length is 1000 words. Photos are encouraged. Due September 30.

Group Presentation/Lesson Plan I: Prepare a lesson from the Integrated Mathematics One textbook Unit 5 or 6 (as assigned) to teach to high school students at Hellgate High School during the weeks of September 13th and/or 20th. These teaching periods will be first period so that you may return by your 9 AM class, but will begin at 7:40 AM. Your lesson is due September 8, with revisions expected before you teach based upon the day-to-day progress of the class.

Group Presentation/Lesson Plan II: Prepare a lesson plan for your group presentation topic. Focus your lesson on either a single investigation related to that topic or a variety of investigations. Consider using ideas from the SIMMS materials. Include at least the topic, grade level, objectives, assessment, materials, and any handouts for the class. Due the day of your group presentation.

Thematic Interdisciplinary Unit - - You will be teamed with methods students from mathematics and science, and expected to develop a minimum of a two-day teaching unit to be taught in your field experience C&I 301/302 during the week of November 8th. This unit should include an appropriate theme, a rationale, unit goals, two lesson plans, appropriate technology, an assessment scheme, and reflection on the implementation of the unit. Due 29 November.

Mathematics (5-12) Content - Each day, mathematics content will be an important part of the class. Students will solve problems and demonstrate expertise in 5-12 grade school mathematics.

Professional Activity - (a) Attend the regional conference of the Montana Council of Teachers of Mathematics (MCTM) held jointly with the Montana Education Association (MEA) annual meeting on October 21 and 22 in Helena at Helena High School. Verify your attendance by identifying the sessions you attended and writing a brief description and assessment of several sessions. Try to select sessions that assist in your Thematic Unit. Due no later than 28 October. OR (b) Attend a professional development activity of your choice. Some options include district inservice activities you learn about at your field placement, seminars that are given on campus on Thursdays in the math department, etc. Write a reflective entry that verifies your participation, what you learned, and your thoughts about implementation of what you have learned. Due no later than 10 November.

Journal - Record of your own thoughts and reflections from your classroom participation and field experiences in this course. You might want to make entries immediately following each class session, but *certainly* no less often than once per week. These should be e-mailed to both your journal team and myself. You should respond at least weekly to comments that others in your team make with additional comments, questions, or insights. Some weeks, specific topics will be assigned. A week ends at midnight Saturday, and all entries you wish to count for a week must be submitted by then.

Portfolio - This is a combination professional portfolio and subject portfolio. For the professional portion, follow the guidelines from the Student Handbook (copy distributed at beginning of course). For the subject portfolio, choose the three items that you consider your best work this semester together with a rationale for each choice. Possible selections include your group presentation, a follow-up from an activity in class, an investigation you wrote for field work, selected journal entries, etc. Include a rationale for the choices as a whole as they relate to the course objectives. Resume and folder due Thursday, 9 September. Completed portfolio due Thursday, 2 December.

Final Exam - Comprehensive semester exam; concentrates on the issues from the readings and class discussions. There will be three parts: (1) a question that you pose before the exam, and then the answer you write during the final; (2) a group exercise; and (3) an essay section. Monday, 13 December 2004, 10:10 AM - 12:10 noon. Please verify this date and time for conflicts with other courses before September 9th.

V. Evaluation

Attendance/Participation	10%	Writing: Journal Article	10%
Group Presentation/Lesson Plan I	10%	Mathematics (5-12) Content	10%
Group Presentation/Lesson Plan II	10%	Journal	10%
Thematic Interdisciplinary Unit	10%	Portfolio	10%
Professional Activity	10%	Final Exam	10%

Letter grades correspond to percentages: 90% - A; 80% - B; 70% - C; 60% - D; below 60% - F.

- Students electing to audit courses must do so within the first three weeks of the term. For Fall, 2004 the last day to elect the audit option is Monday, September 20.

- Monday, September 20, is the last day to drop classes via Cyberbear. After that date (and prior to the last day of classes), students must drop courses by petition, and those petitions to drop must be approved by the Dean or Associate Dean. In order to drop at that point, a student must have circumstances necessitating the drop that are beyond his/her control AND must be able to provide external verification of that reason. Included in that second part may be a clarification that provision of external verification is not the same as the student providing a verbal or written explanation of his/her need, or desire, to drop.

VI. Dynamic Schedule

Date	Topic	Assignment/Reading
30 Aug.	Introduction; Sign-up for group presentations; Algebra Lab Gear I	Write first journal entry: Address (1) what you think it takes to “teach secondary school mathematics successfully,” and (2) “What is algebra?”
31 Aug.	Algebra Lab Gear II	Discuss Chapter 1: <i>Principles and Standards for School Mathematics</i> A Vision for School Math.
1 Sept.	Algebra Lab Gear III	Chapter 2: Principles
2 Sept.	Algebra Lab Gear IV	Chapter 3: Standards pK-12
6 Sept.	Labor Day Holiday	No Class
7 Sept.	8-9 AM Standard: Prob.Solving 9:10-10:10 AM Joint Methods Mtg. #1 in ED 112 10-11 AM: Integrated Math- Science Activity #1	Read in NCTM (2000) for each Standard, i.e., Problem Solving, etc. from here on out. Explanation of Interdisciplinary Work; Discuss article “Curriculum Integration and The Disciplines of Knowledge” by Beane
8 Sept.	Inquiry Lesson	Lesson Plan I due
9 Sept.	8-9 AM Standard: Reasoning & Proof 9-10 AM Standard: Communication 10 –11 AM Questions and Answers	Resume and portfolio with organization due Field work packet – questions for our group?
13 Sept.	8-9 AM Linear graphs:	This week and the following week may be interchanged depending on the high school schedule. This week will count for 5 hours of field work.
14 Sept.	8-11 AM Technology: TI Voyage 200; Geom. Sktchpad	Discussion back on campus after lesson, 9-11
15 Sept.	8-9 AM Graphing Calculators	
16 Sept.	Field Day #1	Meet at assigned schools with name tag and paperwork for school office
20 Sept.	8-9 AM Algebra Presentation	
21 Sept.	8-9 AM Conceptual Underpinnings of Calculus Pres. 9 - 11 AM Joint Methods Mtg #2	Common planning for interdisciplinary units
22Sept.	8-9 AM Discrete Math Pres.	
23 Sept.	Unit 5 Day 1 at Hellgate High School	
24 Sept.	Unit 5 Day 2 at HHS	
27 Sept.	Unit 5 Day 3 at HHS	
28 Sept.	Unit 5 Day 4 at HHS	Discussion back on campus after lesson, 9-11
29 Sept.	Unit 5 Day 5 at HHS	
30 Sept.	Unit 5 Day 6 at HHS Field Day #2	Writing due: Journal article on Big Ideas
1 Oct.	Unit 5 Day 7 at HHS	
4 Oct.	8-9 AM Geometry Presentation	

5 Oct.	8-9 AM Trigonometry Pres.	
6 Oct.	8-9 AM Probability Pres.	
7 Oct.	Field Day #3	

Date	Topic	Assignment/Reading
11 Oct.	8-9 AM Statistics Pres.	
12 Oct.	8-9 AM Variable Pres. 9-11 AM Integrated Math/Science Activity #2	
13 Oct.	8-9 AM Mathematical Structure Presentation	
14 Oct.	Field Day #4	
18 Oct.	8-9 AM Patterns Presentation	
19 Oct.	8-9 AM Spatial Sense Pres. 9-11 AM Joint Methods Mtg.#3	
20 Oct.	8-9 AM Functions	
21 Oct.	Professionalism: MEA Conference at Helena HS in Helena. No class on campus.	Attend 2 sessions if this is your choice of a professional activity; report in journal by 24 Oct. May count as 2 hours of field work.
25 Oct.	8-9 AM Measurement Pres.	
26 Oct.	Standard: Connections	
27 Oct.	Standard: Representation	
28 Oct.	Field Day #5	Professional Activity Report Due if from MEA
1-18 Nov.	Field Weeks #1, #2 & #3 and Field Days #6-17	Teach Units in field during week of 8 Nov.; Note that 11 Nov is a UM Holiday, so you could spend the entire day in the field if you need hours. Professional Activity Report Due 11/10 if other than MEA conference
22 Nov.	TBA	
23 Nov.	TBA	
24 Nov.	Travel Day	NO CLASS
25 Nov.	Thanksgiving Holiday	NO CLASS
29 Nov.	TBA	Interdisciplinary Unit DUE
30 Nov.	9-11 Joint Int. Methods Mtg#4.	Groups share Thematic Units in 7-minute sessions using MS PowerPoint
1 Dec.	TBA	
2 Dec.	TBA	Portfolio DUE
6 Dec.	TBA	
7 Dec.	9-11 AM Integrated Math/Science Activity #3	
8 Dec.	Teacher as Researcher	Discuss Lankford (1993) article
9 Dec.	TBA	
13 Dec.	Final Exam: 10:10 AM –12:10 PM Individual essay; group problem solving; group assessment/evaluation; select 2 of 3 questions from which to respond.	Prepare 20-minute essay question & answer from memory as part of exam.