Department of Mathematics & Statistics
Concordia University

MATH 624M
Topics in Mathematics Education
Fall 2014

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Class Hours: Wednesdays, 18:00-20:15

Office Hours: Monday, 14:00-16:00

Text: A partial list of readings will be posted on the Moodle website of the course two weeks before its commencement. Additional or alternative readings may be given during the course, depending on the interests of the students and the evolution of classroom discussions.

Topics: In the course, students will be given the opportunity to learn about and experiment with:

a. Different conceptions of instructional design:
- as a product of practicing mathematics education as a design science;
- as "didactic engineering", an application of the Theory of Didactic Situations;
- as a process of Lesson Study, the Japanese form of professional development.

b. A range of historical and contemporary instructional methods and approaches, some general and some specific to mathematics:
- the Socratic method;
- Pestalozzi's "Object lessons" and the principles of "Anschauung" and educating "Head, Heart and Hand";
- Herbart's classification of teaching methods into presentative, analytic and synthetic; a Herbartian "ideal" lesson;
- Langevin's principles of Interrogation;
- the Rule Method; the Analytic Method and the Inductive Method;

- E.H. Moore's laboratory method of mathematics teaching;
- the Genetic Approach to teaching mathematics;
- the Structural Approach to teaching mathematics;
- Gagné's principles of educational technology (neobehaviorism)
- Constructivist Approaches;
- the Inquiry Approach;
- the *Realistic Mathematics Education* approach;
- the Problem-based approach;
- Discursive Approaches.

c. Examples of alternative approaches to teaching particular areas of mathematics:
   - The Lebesgue-Davydov approach to teaching multiplication and fractions;
   - Approaches to geometry: Global Deduction; Local Deduction; Intuitive Geometry; Practical Geometry;
   - Approaches to teaching algebra based on different conceptions of algebra: Algebra as generalized arithmetic; Algebra as a study of procedures for solving certain types of problems; Algebra as the study of relationships among quantities; algebra as the study of structures.
   - Approaches to teaching calculus: the intuitive approach; the genetic approach; the set-theoretic formal approach; the multi-representational approach; the infinitesimals approach;
   - Approaches to teaching probability: the axiomatic approach; the local models approach.

Assessment: Assessment will be based on

- quality of participation in classroom discussions (20%)
- classroom presentations (40%)
- a portfolio (40%)
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An edited collection of the student's assignments during the semester will constitute the student's portfolio. There will be 10 written assignments.

Classroom presentations will consist in the student presenting his or her lesson plan on a particular mathematical topic designed according to a particular instructional method or approach and "simulating" conducting this lesson with the rest of the class acting as students. Usually, the simulation will take place first, and

only then the plan will be revealed and discussed with the whole class. The presentations will start in October.

The grade will depend on the clarity, thoroughness, accuracy and depth of the ideas presented in the portfolio and the quality of the student's presentations and participation.

Participation means not only attendance but also being active in the classroom discussions.

Attendance is compulsory. If unable to come to class on a given day, the student should inform the instructor about it as early as possible, and present a valid reason for his or her absence.