Department of Mathematics & Statistics
Concordia University

MAST 652 Section AA – Fall 2018
Topics in Research in Math Education

Instructional Design in Mathematics Education

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Class Hours:	Wednesdays, 18:00 – 20:15
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A course in Research in Math Education:

One of the concerns of Mathematics Education is to link research to the practical needs of the education system. In recent years, the notion of *Instructional Design* (used here to denote, in a large sense, the notions of *Didactical Engineering, Task Design and Design Experiment*) has particularly interested researchers in this area as a methodology to develop research-based tools and processes for use by practitioners. Used either in a one-on-one experiment or in a classroom, or else in the elaboration of a particular curriculum, didactical design is generally conceived to develop theories about the process of learning and the means that are designed to support that learning.

The main goal in this course is to learn about Task Design, Didactical Engineering and Design Experiments in Mathematics Education and to set up a concrete didactical design for a particular topic or project of interest to the students.

Topics:

- Theoretical background for Task Design, Didactical Engineering and Design Experiments in Mathematics Education: emergence and development of frameworks and principles, brief history of the emergence of design-related work from 1960s to the 1990s and current theoretical frameworks and principles of these methodologies in Mathematics Education research.

- Different purposes in setting up a didactical design in Math Education Research (introducing a new mathematical idea, testing students' understanding, correcting a misconception, or even building a curriculum). Essential elements to be considered in setting a didactical design (mathematical organization, didactical organization, didactical analysis of tasks, different types of tasks, etc.). Testing and validating a didactical design (internal validation in didactical engineering, reflective aspect and iterative process in design experiment).

It is expected that at the end of the course the students will be able to propose a didactical design for a particular project, to conduct a pilot (trial) implementation of it and to write a report about their research.

Assessment:

Assignments: Students will have five assignments to complete (for instance: to write reading reports, to answer some questions, to invent or to analyze mathematical tasks, etc.). These assignments will be due for classes 4, 6, 8, 10 and 12 and they will be posted on moodle two weeks before their due date. The average of the best four assignments will count for 40% of the final grade.

Final Project and classroom presentation: As a final project, students will have to propose an instructional design (a design experiment or a didactic engineering) for a particular topic (or project) and to "simulate" conducting it in class, the rest of the class acting as students. The topic will be chosen by the students and validated by the instructor during the third or fourth week of the term.

The final project will consists of three parts. The first one is the planning and "a priori" analysis of the experiment or engineering, the second one is the simulation in class, and the third one is a retrospective analysis and a conclusion to be written after the simulation in class, as a research report.

The final project counts for 60% of the final grade. During the simulation in class, all the students are expected to participate actively.

The grade will depend on:
- the explicit and adequate use of the topics seen in the course (arguments and decisions based on mathematical and didactic concepts studied in the course).
- the clarity, thoroughness, accuracy and depth of the ideas presented on the assignments and the final project.

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.

Texts:

See a partial list of readings below. Additional or alternative readings may be given during the course, depending on the interests of the students and the evolution of classroom discussions.

Artigue, M. (2009). Didactical design in mathematics education. Retrieved May 7, 2012, from *Proceedings of NORMA 08: https://isis.ku.dk/kurser/blob.aspx?feltid=212293*

Cobb, P., Confrey, J., diSessa, A., Lehrer, R. and Schauble, L. (2003). Design Experiments in Educational Research. *Educational Researcher* 32(1), 9-13.

Godino, J, Batanero, C., Contreras, A., Estepa, A., Lacasta, E. and Wilhelmi, M.R. (2013). Didactic Engineering as Design-Based Research in Mathematics Education. In B Ubuz, C Haser and MA Mariotti (Eds) *Proceedings of CERME 8* (pp2810-2819). Ankara: Middle East Technical University.

Kieran, C., Doorman, L.M., & Ohtani, M. (2015). Frameworks and Principles for Task Design. In A. Watson & M. Ohtani (Eds.), *Task design in mathematics education*. New York: Springer.

Academic Integrity and the Academic Code of Conduct

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*