Three Specialized Courses

For Mathematics Teacher Preparation

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Montana State University

- Montana' s land grant university
- Enrollment near 15,000 students
- 120 mathematics majors; 40 in the teaching option
- Mathematics education faculty – historically 5; currently 2, with one Teacher in Residence and two new hires
- Math ed "group" is one of 4 groups in dept

Mathematics Teaching at Montana State

- 120 credit degree program, completed in 4 years, including student teaching
- Students take courses in education and related fields, "core" requirements, and mathematics courses
- Leads to initial licensure in Montana

Program Components (mathematics; 46 cr)

- Calculus I, II, III, Differential equations (16)
- Intro and Intermediate Statistics (6)
- Methods of Proof, Intro Linear Algebra (6)
- Three specialized courses in mathematics for teaching (9)
- Nine credits of upper division mathematics or statistics (9)
- Two mathematics teaching methods courses

Methods of Proof

- Focus is on foundations of analysis
- Logic and mathematical argumentation
- Required by mathematics teaching option, mathematics option, stats option
- Prerequisite to junior-level Real Analysis; prerequisite for all mathematics teaching specialized courses

Content and Approach

- Higher Mathematics for Secondary Teachers
- Modern Geometry
- Modeling for Teachers

Content and Approach

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- Perspective: These courses will enable you to be a professional decision maker in a standards-based classroom.
- Require students to be professionals, not students

Higher Mathematics for Secondary Teachers

- Number theory, abstract algebra, and combinatorics
- "Grew" out of a discrete mathematics course
- Focus is on problems originating in high school mathematics – text is Usiskin *et. al.*

Modern Geometry

- Euclidean geometry, including a transformational approach to proofs
- Hyperbolic geometry and emphasis on Euclid's fifth postulate
- Focus on high-school level topics, mathematical argumentation
- Inquiry-based course, student-led mathematical discussions
- Dynamic software to explore and conjecture

Modeling for Teachers

- Pre-college mathematics
- Deterministic, empirical and stochastic models
- Statistics and simulation
- Finite differences, modeling with trig functions
- Study of modeling in the Common Core
- Spreadsheet and calculator technology

Program Self-Assessment

- One course formally assessed each semester using a "signature assignment" and department's established learning outcomes
- Ongoing evaluation based on students' abilities to explain Common Core topics

What we've changed

- Moved away from "Statistics for Scientists and Engineers" (which left our students saying things like "statistics is just calculus") to a data-based, simulation-based intro to statistics and a second course in intermediate stats. (Fortunate in our statistics colleagues.) We use the modeling course to follow up on statistical concepts.
- *MET II* gave us "permission" to move from a 300-level to 2 200-level courses

What else we've changed

- Moved away from a multiple-subject pathway that allowed fewer mathematics courses in exchange for a teaching minor to only the more mathematics-intense single subject path. (Teaching minor still available).
- Trade-off in the single subject path was removal of Real Analysis as a required course (replaced by an upper division elective)

In Geometry

- Transformational geometry always covered now
- Common core explicitly addressed through Illustrative Mathematics projects
- Purposeful choice of GeoGebra because it is free, and we want to encourage students to consider what they will have access to

In Modeling

- Moved away from TI-Nspire technology, because it is not used in the field
- Purposeful emphasis on simulation in statistics, for example in understanding margin of error
- Connection to Common Core through Illustrative Mathematics task project

What makes this work

- The mathematics education faculty group is autonomous – can make our curriculum decisions in an environment of mutual trust with mathematicians and statisticians
- Coincides with curriculum change in introductory statistics to simulation based curriculum

What else makes this work

- Mathematics education faculty have a balance of mathematics content background and mathematics education research background
- Focus in this program is on professional preparation for teaching high school
- Follow-up in our Master's of Science in Mathematics – mathematics teaching program. (Blended program online school year/3 week summer session for practicing high school teachers)

Questions or Ideas?

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