Modeling in an Integrated Mathematics and Physics course

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Department of Mathematics
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Joint Math Meetings
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About Creighton University

Catholic, Jesuit school located in Omaha, Nebraska.

Approximately 700 Freshman Arts and Sciences students per year.

Around half are pre-med.

10% have a 32+ Math ACT score.

10−15 math majors per year.
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• 10 – 15 math majors per year.
Mathematical Modeling of the Physical World

• Six Credit Hour team-taught course with member of the Physics department.
• Students receive credit for Calculus II and General Physics I.
• Spring semester covers Calculus III and General Physics II.
• Physics taught from a more conceptual standpoint with an emphasis on vector calculus.
• Course designed around group-based modeling projects.
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Course Structure

- Regular homework/quizzes oriented toward the projects.
- Two group modeling projects per semester.
- Two-part final exam.
  - One part project oriented.
  - One part similar to standard Calc II and General Physics finals.
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Project Logistics

• Students placed in groups of 3−5.
• First project assigned about a month into the semester.
• First draft due after about two weeks.
• Final draft due a week after drafts are returned.
• Students use Overleaf to Latex the projects and use CATME to rate their group members.
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What We’ve Learned

• Writing is hard for undergraduates.
• Many students have very poor coding and technical skills.
• Projects are scalable.
• Finding the right students can be a challenge.
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What We’ve Learned About Group Projects

• Groups work pretty well.
• Projects assigned in stages, to prevent partitioning.
• Students will use any amount of time they are given.
• Spend first Thursday/Tuesday working on projects during class time.
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What We’ve Learned About Student Impact

• Focus on projects detracts from Calculus knowledge.
• Students build a peer group.
• Improves student independence.
• Students learn to ask for help.
• Prepares students for undergraduate research projects.
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Challenges

- Diminished Calculus/Physics skills.
- Finding ideal class size.
- Managing student stress.
- Team teaching can be awkward.
- Students don't have a uniform skill set.
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