Transitioning to a Modeling-First Approach in Differential Equations

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SIMIODE EXPO
Outline

(i) Introduction
(ii) Why Modeling-First?
(iii) ODE/Math Modeling Course Development.
(iv) Modeling-First Student Feedback.
(v) Modeling Activities/Resources.
Introduction and Context

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Teaching focused institution/department.
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- We offer an ODE course as well as a Math Modeling course.
- No engineering school at Worcester State. Students taking ODE are typically math majors, with some exceptions.
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Teaching Traditionally

- Student interest in the material was low/average.
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- Student **interest** in the material was low/average.
- Differential Equations are dynamic and fun. Why present them in such a boring way!
- A colleague forwarded me an email from SIMIODE...
Differential equations form a significant part of STEM curricula. SIMIODE is an education community where modeling comes first in teaching differential equations. Modeling engages and motivates students; it makes them curious. SIMIODE offers curriculum materials, opportunities for collaboration, and peer-reviewed publishing for faculty and students, all in a Community of Practice.
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Use modeling to motivate techniques. Do it early!
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• However, we offer a “Math Modeling” course that I am currently teaching and taught in Fall 21. This course covers discrete (difference equation) models, differential equation models, as well as a statistical models.
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• I wanted to focus on introducing a model first, then focus on solving techniques/mathematical analysis afterward.
Math Modeling Course Development

- Ask your colleagues!
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• After teaching in Fall 21, some students reported that they enjoyed the smaller modeling activities, but they wished they could have tackled larger problems.
• This semester, students have a larger project/presentation.
After “Math Modeling” in Fall 21. I sent an anonymous survey which I wouldn’t see until after grades were submitted. In the survey, I asked the students to respond “Strongly Agree”, “Agree”, “Neutral”, “Disagree”, or “Strongly Disagree” to the following statement:

“The in-class modeling activities provided motivation to learn techniques for solving and analyzing differential/difference equations (i.e equilibria/stability analysis).”
• 80% of students responded “Strongly Agree” and 20% of students responded “Agree”.

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• First day Hot Potato. Adopted from a SIMIODE Expo 2021 talk that I attended.
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- Murder Mystery activity: Separation of Variables technique.
Modeling Examples

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- Murder Mystery activity: Separation of Variables technique.
- Boarding School Flu Pandemic: Logistic Growth/SIR Model
SIMIODE Resources

- SIMIODE has a plethora of ready-to-use resources available at their website: https://www.simiode.org/
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• Many have downloadable Tex files that you can edit to your liking.
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• At the end of the week, each participant presents a group modeling demo. You can use these in your own classes!
Thank you!