- Course Development
  If communication between Dept’s: how often should they meet? How to ensure L.O.Ss are met?
  How to ensure curriculum is in line with L.O.Ss?
  → useful to know how other departments run their courses - that is what these students are used to.
  → Team teaching?
  → insight into what the students will actually need in future courses/jobs in their area.

- The Debate
  Relate the Math to the area or focus on the Math itself.
  → could depend on circumstance.
  → Tools vs Application (Balance?)
  → too much focus on technique loses the bigger picture for the students.

- Instructor Choices
  Math instructor or Instructor from the program?
  → Depends on many factors.
  → Should they be service courses?
  → Disciplinary boundaries are becoming less relevant.
  → Could hire PhD’s from other disciplines to help out (or teach it).
  → Want realistic interpretations for applied problems. So knowledge in the area is an advantage.
  → Learning objectives are very content oriented as opposed to other disciplines are more high level.
  → Maybe more to 80% math content based, but have 20% where the instructor can be creative.
→ Maybe move to 80% math content but have 20% where the instructor can be creative
→ Maybe blended learning can help to reduce the amount of class time spent on skill-based problems.
→ Fairness vs. uniformity
→ Instructor/Student relationship should be individual

What should we do next?

Working Group: Life Sciences Calculus

• Special Topics
  ① Discrete Dynamical Systems (~2 weeks near end + 1 lecture in term.
    • equilibrium
    • Recurrence Relation
    • initial conditions impact behaviour.
    • Python
    • Applications.
  ② Power Analysis/Asymptotic Reasoning (~ 3 weeks)
    • Relate to L'Hopital's Rule
    • Beginning of course

③ Intro to DE's
    • Phase diagrams
    • Slope fields
    • Qualitative behavior
→ Some do not do in detail or at all
  • Continuity / Differentiability / proofs
  • Graphing
  • EVT / IVT / MVT / limits
→ Blend of Qualitative Thinking vs. Procedural Techniques.
→ Equivalency to other courses forces extra procedural things
→ What is really valuable?
What is really valuable.

What can we give up/lighten?

- Pathological Functions
- \(\varepsilon - \delta\) proofs
- MVT - EVT
- Rigorous notions of continuity & differentiability
- Formal proof
- (non-science relevant) graphing
- Limits
- Related Rates (ladders, etc.)
- Optimization (fields, etc.)
- EVT

*Authenticity of content.

How to Build Authentic Content? What does Authentic mean?

How can I check?

- Is it teachable by everyone who needs to teach it?
- How can equivalency be maintained?
- Give story, why function makes sense
- Explain why assumptions happen
- Able to convince students the model makes sense at some level.
- Realistic Mathematics Education (Holland)

What can we gain?

- Interpretation of results (in terms of context)
- Is the model suitable? Evaluation of plausibility?
- Comfortable with approximations.
- "Stickiness" - Resonates with students longer
- Deeper understanding of concepts (functions, rates of change, ...)
- Scientific Skepticism.
- Limitations of models.
- Dynamical Systems/Probability/DE's/etc.

Possible Worries

I'm not an expert - what if I can't answer
Deeper understanding of concepts (functions, rates of change, ...)  
Scientific Skepticism.  
Limitations of models.  
Dynamical Systems/Probability/DE's/etc.

Possible Worries
- I'm not an expert, what if I can't answer a question  
- I don't have time to learn this stuff  
- Might not want to do blended method.  
- Helpful Mechanisms
  - A week-by-week outline of objectives, worked examples, slides  
  - Weekly meetings to go over teaching materials.

- What can replace fields example?  
  - Why are beehives hexagonal?  
    - Cross-section of a bee is circular  
    - Wants to fit without lots of space (use a regular polygon)  
    - Which polygon approximates a disk the best?  
    - Only 3 can tile the plane ⇒ must be hexagon (most sides)
  - Maximize amount of food given availability, distance  
  - North western crows drop whelks to break them  
    - Records how many drops it takes for given heights  
    - Fit a function to observed points  
    - Minimize energy (# of drops) is optimal height  
    - Revisit problem throughout course (more comfortable since familiar)
  - Cell Growth Examples.
Takeaways
- Want to be authentic & what that means
- What we’re willing to give up.
- What we gain.
- How it might work.
- Not specific to life sciences, so any calc. course (not for math majors) could be transformed with faculty-specific examples.

Gerda de Vries: Service Courses: From the Viewpoint of an Instructor & Administrator.

- Students very diverse.
  - Break-up large cohorts by interest
  - Address Diversity in Student Population;

1. What do we teach? Should we teach? Within the limited resources.
   - Too many students going through Calculus.
   - More variety
   - More on abstract thinking, proofs, math approaches to games,
     - Challenge to convince other programs to change requirements.
   - Courses packed too much.

2. How do we teach? Should we teach? Within the limits.
   - Blended learning has benefits.
   - Instruction depends on instructor.
     - Can be very different
     - Unfair to students?
     - Consolidation also has challenges.

3. What do we expect students to be able to demonstrate at the end of the course?
What do we expect students to be able to do at the end of the course?

What do we assess?
How do we assess? Should we assess?
Within the limits of the resources?

• give students an idea on what to expect (60% procedural, ..., etc)
• traditionally only assessments are test & exams.
  • is this best?
• McMaster: no final > 40%
• Many at 55-60%
• Rest of mark on Midterm(s)/Quizzes
• Assignments usually 10-20%
• Evolution in course breakdown?
  • trend for earlier & more frequent assessments.
  • when every course does this it can be stressful to students.
  • more assessment gives students a better idea of their status in the course
    • more informed decisions (drop/stay).
  • teacher & student burn-out in courses with lots of assessment.
  • should we be babying our students?
• What about other things?
  • projects, etc.
  • resources might not be there.
  • get feedback elsewhere?
  • can you implement something else on a broad scale?