MORE DISCIPLINES WITH LESS COURSE OFFERINGS:

HOW DO YOU TEACH 300 STUDENTS WITH DIFFERENT BACKGROUNDS FROM DIFFERENT DISCIPLINES THE SAME CORE COURSE?

RYAN CLEMMER, SOHA EID MOUSSA, JULIE VALE

WESTERN CONFERENCE ON SCIENCE EDUCATION, 2013
OUTLINE

Challenges of large classes
What is different about Engineering at Guelph?
Our biggest hurdle: diverse student needs
Some strategies (interactive!)
CHALLENGES OF LARGE/SERVICE CLASSES

What is large? What are the challenges?
ENGINEERING AT GUELPH

NON-TRADITIONAL
NON-DEPARTMENTALISED
WHAT DOES IT LOOK LIKE?

Teaching focused faculty (hi!)

Part of the College of Physical and Engineering Sciences

Midsized: approximately 300 students/year (and growing!)

A mix of non-traditional and traditional programs
NON-DEPARTMENTALIZED: STRENGTH OR WEAKNESS?

Excellent multi-disciplinary interaction – particularly design courses

Greater flexibility in choosing courses and electives – programs are not batches!

BUT

Different backgrounds and required outcomes in the same course – how to manage?
FOR EXAMPLE....

<table>
<thead>
<tr>
<th>Prereq. course</th>
<th>Water must take</th>
<th>ES&amp;C must take</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG*2450</td>
<td>None</td>
<td>ENGG<em>3450 ENGG</em>3410 ENGG*3640</td>
</tr>
<tr>
<td>Electric Circuits</td>
<td></td>
<td>Electrical Devices Systems &amp; Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microcomputer Interfacing</td>
</tr>
<tr>
<td>ENGG*2230</td>
<td>ENGG*3590 Water Quality Hydrology</td>
<td>ENGG<em>3260 Thermodynamics ENGG</em>3430</td>
</tr>
<tr>
<td>Fluid Mechanics</td>
<td>ENGG*3650 Hydrology</td>
<td>Heat and Mass Transfer</td>
</tr>
<tr>
<td></td>
<td>ENGG*3670 Soil Mechanics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENGG*4360 Soil-Water Conservation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENGG*4370 Urban Water System Design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENGG*4250 Watershed Design</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNDERSTANDING THE PROBLEM

DIFFERENT INPUTS AND DIFFERENT OUTPUTS
TERMINAL VS. FOUNDATIONAL

Core courses may be the beginning of a progression or they may be the only course required.

Engineer vs. technician – sufficient fundamentals without overwhelming.

Results in many content-heavy courses, but they lack depth.

<table>
<thead>
<tr>
<th>Street</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mech.</td>
<td>Enviro</td>
</tr>
<tr>
<td>Bio.</td>
<td>Biomedical</td>
</tr>
<tr>
<td>ES&amp;C/CE</td>
<td>Fluids</td>
</tr>
</tbody>
</table>

- Biomedical
- Mechanical
- Biological
- Environmental
- Fluids
DOUBLE OFFERED COURSES

E.g. ENGG*1210 – Mechanics

- Offered in fall and winter
- Calculus in fall, physics in winter

<table>
<thead>
<tr>
<th></th>
<th>F Mechanics</th>
<th>W Mechanics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus – integration</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Physics – applications</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>
MATURITY

Some courses have multiple years taking the same course – co-op can complicate this! Maturity difference poses challenges with study skills, expectations, background, etc.

- E.g. ENGG*3240 – Economics
IN SUMMARY

Common core courses have students with different:

• Maturity
• Curriculum requirements
• Levels of engagement
• Levels of preparedness
• Need for depth of understanding
STRATEGIES

WHAT WE’VE TRIED... AND A PLEA FOR HELP!
WHAT WE’VE TRIED:
The STANDARD STUFF

Active Learning – Clickers, think pair share
Discipline specific analogies
Scaffolding – specifically in labs
Real world examples – engineering and daily life
Extensions in lecture notes (not assessed!)
COMMON OFFICE HOURS
A NEW IDEA?

Three courses: circuits, controls, digital process control
One professor (Julie!)
700 students, 15 teaching assistants
One room, one time, all three courses, prof and TA support both present
WHAT ARE YOUR TECHNIQUES?

Thoughts?
Comments?
Suggestions?
MOST FIGURES CAME FROM PRESENTERMEDIA.COM....
JULIE HIGHLY RECOMMENDS IT!