A PARTIAL FLIP, A WHOLE TRANSFORMATION: REDESIGNING SOPHOMORE CIRCUITS

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Background

• Required Circuits II course
• 3 sections of 30 students each semester
• Instructor focused learning – chalk and talk
• Common end-of-course advancement exam
The eFellows Program

• 2011 Provost eFellow
• Initial requirement included reduced seat time
• Looked at entire curriculum objectively
• Methods to increase success
Blending a Flip

• What do students pay attention to?
• How do students really learn?
• If we are to reduce class time, while increasing success, what is the best way to change teaching strategies?
Strengths of the Partial Flip

- Student pace
- Time in class to reinforce
- Preserve instructor teaching style
- Student perceptions
Format

- Two 50-minute class sessions per week, down from three sessions
- Short video lessons, fully ADA compliant
- Online quizzes after video lessons
- Three in-class exams
- Final Exam
- Out of class homework
Online Materials

• Video lessons
  – Annotated PowerPoint Slides
  – Wacom Tablet – low cost choice
  – Camtasia Studio
  – Closed Captioned

• Quiz after each video

• Students review and re-watch
Frequency Response Video Lesson

The basic material is constructed in advance, annotations and explanations added during recording just as during traditional lecture.
Shorter videos are more successful

Even when the material is required, students struggle to watch longer videos. Class may be 50 minutes, but video is best when about 5 minutes.

Quizzes in the LMS

**Question 1**
You have a circuit containing a DC source and a sinusoidal source. When finding the steady state output for the DC source, you should replace each capacitor in the circuit with:

- $\frac{1}{(\omega C)}$ where $\omega$ is the angular frequency of the AC source
- You should do both sources at the same time rather than using superposition.
- a short circuit
- an open circuit

**Question 2**
When performing superposition on a circuit containing four AC sources with differing angular frequencies, the first step is to:

- turn off one source and keep the remaining three turned on
- keep one source on and turn off the others
- turn off two of the sources and keep the remaining two turned on

**Question 3**
Suppose you have a circuit with three sinusoidal sources, each with a different angular frequency. When you have found the phasor contributions to the output for each of the individual sources, then you should add the phasors to get a single phasor output for all the sources.

- True
- False

**Question 4**
You have a circuit containing a sinusoidal current source with an angular frequency of 100 rad/sec and a sinusoidal voltage source with an angular frequency of 25 rad/sec. Additionally, your circuit contains a 5 mH inductor. The inductor should be replaced by:

- 0.05 ohms
- 0.2 ohms
- a short circuit
- 0.2j ohms for the step involving the current source and 0.05j ohms for the step involving the voltage source.
During Class

- Some traditional lecture retained
  - Conducted in questioning method
- In-class group problem solving
  - One problem per group of 3-4 students
  - Students encouraged to discuss potential solutions
Results

- Students not originally in blended section requested video access
- Students provided positive response to reduced class time
- Exam scores did not significantly change when compared to traditional classes
Exam Scores

Exam 1

Exam Percentage

Summer 2009 | Summer 2010 | Fall 2011 | Spring 2012 | Fall 2012 | Spring 2013 | Summer 2013 | Fall 2013

Traditional | Traditional | Traditional | Traditional | Traditional | Traditional | Traditional | Traditional

Blended | Blended | Blended | Blended | Blended | Blended | Blended | Blended
Exam Scores

Final Exam

<table>
<thead>
<tr>
<th>Semester</th>
<th>Traditional</th>
<th>Blended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 2009</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Summer 2010</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Fall 2011</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Spring 2012</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Fall 2012</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Spring 2013</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Summer 2013</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Fall 2013</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>
## Student Satisfaction

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would prefer that the course be taught in a traditional lecture.</td>
<td>6</td>
<td>10</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>The online material was easy to access.</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>The blended format required too much time outside of the classroom.</td>
<td>8</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>I liked the format of the video lessons.</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Viewing the lessons before coming to class helped in my understanding of the</td>
<td></td>
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</tr>
<tr>
<td>material.</td>
<td></td>
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</tr>
<tr>
<td>I think these lessons should be available to all EE/CpE students for reference</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>in later courses.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I would recommend this course (in blended format) to my friends.</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>13</td>
</tr>
</tbody>
</table>

### Too Long, About the Right Length, Too Brief

The video lessons were:

- Too Long: 3
- About the Right Length: 18
- Too Brief: 0

### Learning, Studying, Homework, Other

I have used the video lessons for:

- Learning New Material: 18
- Studying for the Exam: 12
- Homework: 17
- Other: 0

n=21
Senior Survey
Student Comments

- I think the videos were the perfect length with just the right amount of content. It might have been neat to see some real-world applications in a sort of "How It's Made" format but that might be going a bit over the top.
- It made it easier to refer back to a particular lecture if you were weak in any one area.
- The videos were better than having notes because you had the lecture along with the notes so you did not miss the little things that were said that you sometimes miss while taking notes.
Conclusions

• Student success maintained
• High student satisfaction
• Allows greater flexibility
• Encourages students to become self-learners