Teaching Resources

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Resources: https://trefnycenter.mines.edu/newfac
Facilitators

Kristine Callan (she, her, hers)
Facilitators

Sarah Bodbyl Roels (she, her, hers)
By a show of hands...

- Have you taught before?
- Have you previously taught some versions of the class(es) you will be teaching?
- Are you familiar with learning outcomes?
- Are you teaching a class with sections...
  - Smaller than 20?
  - Between 20 and 50?
  - Greater than 50?
Session Learning Outcomes

1. Articulate a preliminary learning outcome for a course you are teaching
2. Identify strategies to establish a productive classroom environment from day one
3. Select one active learning technique you plan to use
Structure

Before you start

On day one

As you go

https://trefnycenter.mines.edu/newfac
Before You Start

What is one thing you hope students will be able to do by the time they finish your course?

By the end of this course, students will be able to...

Discuss in pairs – 2 minutes each
Learning Outcomes

Identify applications of electromagnetics in your daily life and your work as an engineer, and employ EM concepts and terminology to explain how these technologies work.

Interpret physical phenomena portrayed by different representations (e.g., pictures, graphs, equations) and translate between different representations as needed.

Why is it helpful to articulate learning outcomes? (2 min)
## Tools for Writing LO – Bloom’s

### Verbs for Bloom’s Taxonomy

<table>
<thead>
<tr>
<th>Recall</th>
<th>Interpret</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
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</thead>
<tbody>
<tr>
<td>Arrange</td>
<td>Classify</td>
<td>Calculate</td>
<td>Combine</td>
<td>Appraise</td>
<td>Assemble</td>
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<tr>
<td>Define</td>
<td>Describe</td>
<td>Construct</td>
<td>Figure</td>
<td>Argue</td>
<td>Compose</td>
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<td>Locate</td>
<td>Indicate</td>
<td>Demonstrate</td>
<td>Find</td>
<td>Assess</td>
<td>Create</td>
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<tr>
<td>Recall</td>
<td>Organize</td>
<td>Estimate</td>
<td>Sketch</td>
<td>Estimate</td>
<td>Design</td>
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<tr>
<td>Recite</td>
<td>Interpret</td>
<td>Appraise</td>
<td>Solve</td>
<td>Judge</td>
<td>Devise</td>
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<td>Describe</td>
<td>Illustrate</td>
<td>Contrast</td>
<td>Predict</td>
<td>Predict</td>
<td>Formulate</td>
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<tr>
<td>Repeat</td>
<td>Reorganize</td>
<td>Criticize</td>
<td>Change</td>
<td>Qualify</td>
<td>Invent</td>
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<tr>
<td>Identify</td>
<td>Translate</td>
<td>Diagnose</td>
<td>Survey</td>
<td>Rate</td>
<td>Manage</td>
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<tr>
<td>Select</td>
<td>Paraphrase</td>
<td>Identify</td>
<td>Compare</td>
<td>Support</td>
<td>Modify</td>
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<tr>
<td>Quote</td>
<td>Summarize</td>
<td>Classify</td>
<td>Diagram</td>
<td>Critique</td>
<td>Organize</td>
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<tr>
<td>Label</td>
<td>Transform</td>
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<td>Evaluate</td>
<td>Recommend</td>
<td>Plan</td>
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<td>Copy</td>
<td>Discuss</td>
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<td>Prepare</td>
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<td>Name</td>
<td>Explain</td>
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<td>Propose</td>
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</table>

### Tools for Writing LO – “Bloom’s”

- **LOTS:** Lower Order Thinking Skills
  - Arrange
  - Define
  - Locate
  - Recall
  - Recite
  - Describe
  - Repeat
  - Identify
  - Select
  - Quote
  - Label
  - Copy
  - Name

- **HOTS:** Higher Order Thinking Skills
  - Recall
  - Interpret
  - Apply
  - Analyze
  - Evaluate
  - Create

Individually, write one learning outcome for your course, based on the goal you discussed earlier (3 min)
Day One

What is important to accomplish on the first day? What are some ways to do that?

1. Think silently (1 min)
2. Discuss in pairs (1 min)
3. Share as a whole group (1 min)
Day One – Our List

Get to know students
Share instructor(s) background(s)
Set course expectations
Convey course structure
Communicate value, relevance, and excitement
Review pre-requisite material
Answer the following questions to help me get to know a little about your interest in physics, which aside from helping me teach the class will also help me learn your name! Full credit will be given for responses with 3–6 thoughtful sentences.

What interests or excites you about physics (could be a particular topic, or the way you approach it, or something else entirely)?

What interests or excites you about this particular class?

What aspect of this class are you the most apprehensive or uncertain about?
Norms Setting Activity

Set of ground rules around which a group has agreed to work; become part of groups’ “normal” behavior

*Individually:* Make a list of behaviors that make group work more productive and enjoyable. (2 min)

*Group:* Share your lists, discuss, and ultimately make a new list that everyone agrees upon. Submit final list in Canvas. (5 min)
Example Norms List

Be nice
Make sure everyone participates
Make sure everyone gets listened to**
Don’t interrupt
Be prepared for class
Two-Stage Review Quiz (if time)

- Students tune out familiar material making review lectures particularly ineffective
- “An Improved Design for In-Class Review”
  - Take review quiz individually first
  - Immediately take again in groups with right/wrong feedback
  - Gives students a chance to practice old material and accurately identify gaps
Thoughtful Syllabi

In addition to what’s on the template:

What you expect from students (e.g., out-of-class time, participation, preparation, attitude)

What students can expect from you (e.g., office hours, email responsiveness, preparation, attitude)

Intriguing learning outcomes!

See examples: https://trefnycenter.mines.edu/newfac
Active learning – Any learning activity that engages students above and beyond passively listening and taking notes

Freeman et al., 2014
- Reviewed 225 published studies looking at the impact of various active learning interventions
- Looked at impact of active learning on students’ scores as well as on failure rates
Prediction: What did Freeman *et al.* find with respect to students in classes with active learning instruction?

<table>
<thead>
<tr>
<th>Scores (e.g., exams, concept inventories)</th>
<th>Failure Rates</th>
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<tbody>
<tr>
<td>The same</td>
<td>The same</td>
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<tr>
<td>Higher</td>
<td>Higher</td>
</tr>
<tr>
<td>Lower</td>
<td>Lower</td>
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</table>
What are examples of AL we’ve modeled?

Knowledge check questions
Discussing LO in pairs
Full group brainstorm for purposes of LO
Applying what we learned about LO to own course
Predicting results of Freeman paper
Think-pair-share for day one
...this activity
Others?
A tennis racket and a can of balls together costs $110. The tennis racket alone costs $100 more than the can of balls. How much does the can of balls alone cost?

A) $5
B) $10
C) $11
D) $100
E) -$10
Clicker Guidelines

- Not a magic bullet – have to be used well
- Rapid, reliable feedback to you and students
- Best questions incorporate:
  - important concepts
  - challenging ideas
  - multiple plausible answers that reveal student confusion and generate spirited student discussion

https://trefnycenter.mines.edu/newfac
Wrap Up

Think-pair-share:

1. What “day one” activity (e.g. Quick Write, Norms Setting, Two-Stage Review, etc.) seems the most promising to you and why?

2. What active learning strategy do you first plan to implement and why?
Resources: https://trefnycenter.mines.edu/newfac

- Slides and lesson plan from today
- Before you Start
  - Engineering Learning
  - Learning Outcomes
- Day One
  - Norms and Consequences
  - Creating and Inclusive Classroom
  - Thoughtful Syllabi
  - Formative Assessment and Sharing Expectations
- As You Go
  - Effective Teaching
  - Using Active Learning Strategies
  - Canvas
  - Ongoing Professional Development and Support
- Trefny Center – meet with us!