To Flip or Not To Flip?

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What is a Flipped Classroom?

- Discipline-specific
- Students do work ahead of time
- Class-time spent clarifying misconceptions and “high-touch” activities
- Leverages power of technology

**Module Structure**

<table>
<thead>
<tr>
<th>Before Practice</th>
<th>During Practice</th>
<th>After Practice</th>
<th>During Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning outcome guide</td>
<td>Respond to muddiest points</td>
<td>Prepare lab</td>
<td>Monitor quiz</td>
</tr>
<tr>
<td>Pre-assessment</td>
<td>(Review material)</td>
<td></td>
<td>Guide students on lab</td>
</tr>
<tr>
<td><strong>Student</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviews learning outcome guide</td>
<td>Clarifies misconceptions (group/individual)</td>
<td>Review material, study for quiz</td>
<td>Practice</td>
</tr>
<tr>
<td>Books, videos, applets, other</td>
<td>Engaged with material at their level</td>
<td></td>
<td>Deeper value and understanding</td>
</tr>
</tbody>
</table>

### Learning Outcome 10 – Correlation and Regression (for two numeric variables)

Scatterplots are a graphical representation of the relationship between two numeric variables. Y is the dependent and X is the independent variable.

**Describe four things:**

1. Linear or non-linear
2. Nature and strength of relationship (see correlation)
3. Constant variance
4. Other interesting facts, including outliers

**Correlation** – describes nature (pos/neg) and strength (how close to line) of relationship

*Only describes linear relationship*  
Guide: 0-0.3 = weak, 0.3-0.7 = moderate, 0.7-0.9 = strong, 0.9-1 = very strong

0 is no linear relationship, 1 is perfect linear relationship

\[ r^2 = \frac{SS_{yy} - SS_{yy}^*}{SS_{yy}} \]

**Regression** – produces the line of best fit

The equation: \[ y_i = \beta_0 + \beta_1x_i + \epsilon_i \]

The estimate: \[ \hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1x_i \]

Residual = observed (from data) – predicted (from line)

The line is determined by minimizing the sum of the squared residuals

**Typically, we test**

\[ H_0: \beta_1 = 0 \text{ vs. } H_a: \beta_1 \neq 0 \]

Using

\[ t = \frac{\hat{\beta}_1 - \beta_1}{SE(\hat{\beta}_1)} \]

**Assumptions:** Independent observations, linear model

Typically, use \( t \)-test. By, just using \( \hat{\beta}_1 \) and

\[ t = \frac{\hat{\beta}_1 - \beta_1}{SE(\hat{\beta}_1)} \]

Where

\[ SE(\hat{\beta}_1) = \frac{s}{\sqrt{SS_{xx}}} \]

Typically, use \( t \)-test. By, just using \( \hat{\beta}_1 \) and

\[ t = \frac{\hat{\beta}_1 - \beta_1}{SE(\hat{\beta}_1)} \]

**Assumptions:** Known or estimated variance of each data point.
### Example of Learning Resources

<table>
<thead>
<tr>
<th>InfSSP-1</th>
<th>Book Sample size (for CI) - one mean</th>
<th>Ott &amp; Longnecker</th>
<th>Chapter 5.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>InfSSP-2</td>
<td>Book Sample size (for CI) - two means</td>
<td>Ott &amp; Longnecker</td>
<td>Chapter 6.6</td>
</tr>
<tr>
<td>InfSSP-3</td>
<td>Book Types of Errors</td>
<td>Ott &amp; Longnecker</td>
<td>Chapter 5.4</td>
</tr>
<tr>
<td>InfSSP-4</td>
<td>Book Power</td>
<td>Ott &amp; Longnecker</td>
<td>Chapter 5.4</td>
</tr>
<tr>
<td>InfSSP-5</td>
<td>Video</td>
<td>Power Professor</td>
<td>Parris</td>
</tr>
<tr>
<td>InfSSP-6</td>
<td>Video</td>
<td>Power Health</td>
<td>Michael Karsy</td>
</tr>
<tr>
<td>InfSSP-7</td>
<td>Video</td>
<td>Power Stoney</td>
<td>P94</td>
</tr>
<tr>
<td>InfSSP-8</td>
<td>Video</td>
<td>Types of Errors and Power</td>
<td>Mr. Tarrou</td>
</tr>
<tr>
<td>InfSSP-9</td>
<td>Video</td>
<td>Sample size calculation (for CI)</td>
<td>Khan Academy</td>
</tr>
</tbody>
</table>

### Traditional vs. Flipped Classroom

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Flipped</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time on Task</strong></td>
<td>Class-time, homework</td>
<td>Pre-learning. Class-time, studying for quiz</td>
</tr>
<tr>
<td><strong>Making Connections</strong></td>
<td>Some time on real-world applications</td>
<td>More time on real-world applications (during lab) Individual connections</td>
</tr>
<tr>
<td><strong>Real-time Feedback</strong></td>
<td>Homework feedback given 1+ weeks later</td>
<td>Misconceptions clarified in class Quiz feedback given next class</td>
</tr>
<tr>
<td><strong>Competing Mental load</strong></td>
<td>Learning time controlled by professor</td>
<td>Allows (but relies on) student-centered learning</td>
</tr>
</tbody>
</table>

### Examples of “Labs”

- Determining the number of smoke detectors needed to install in order to detect a fire reliably (probability)
- Determining optimal pizza production to maximize profit (expected value and graphics)
- Who is the best hitter in baseball (standardization)
- How many stars are in the sky (sampling)
- Tangram competition (inference and design)
- Predicting house values (regression)
- The effect of leaf removal on fruit growth (combined methods)
- Getting repair estimates from garages (paired vs. independent tests, power calculation)

### Reflections on Flipping

- **My Reflections**
  - Preparation time is different and much more (at beginning)
  - Student-centered learning works well if students are motivated
  - Be clear regarding expectations/assignments
  - I covered more material and had time for student projects

- **Student Feedback**
  - I don’t like it. I like learning in class.
  - Complain to Chair – “no teaching” going on and he didn’t warn us about the class
  - It has been challenging adjusting, but I have faith in the idea
  - It was hard at the beginning but became easier
  - I like it a lot!!! I wish more classes, especially math and science ones, ran this way. It just makes sense - particularly at a college level - that you as an individual spend more time learning the basics and then come in to class where the professor serves to help fine-tune what you’ve learned and make sure you have your cards in the right order.
  - I like this set up because it allows me to spend as much time as I need to learn the material and then stop once I understand the material. In many classes, teachers either spend too much time or too little time on topics making the classes harder to follow and some hw harder to complete. I also like the flipped because it allows me to do more problems in class where I can get help from classmates or the teacher if needed.