Flipping 101: How to Flip Your Course to Engage All Students

CMC³-South

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Objectives

- What is the Flipped Classroom?
- 21st Century Student
- Advantages and Disadvantages
- Flipped Course Model
  - Online Modules
  - Ticket in the Door
  - Mathematics Lab
- CSU Course Redesign with Technology
  - Focus College Algebra
- Results/Future Study
- Student/Faculty Testimonies
What is The Flipped Classroom

"With teacher-created videos and interactive lessons, instruction that used to occur in class is now accessed at home, in advance of class. Class becomes the place to work through problems, advance concepts, and engage in collaborative learning. Most importantly, all aspects of instruction can be rethought to best maximize the scarcest learning resource—time."

"www.educationnext.org"
The Flipped Classroom

Text Book
The Flipped Classroom
A Change in Pedagogy

Traditional
• Lectures are teacher directed
• Lessons introduced during class
• Students complete assignments at home

Flipped
• Students centered
• Content introduced at home
• Students apply it at school
• Teachers provide more one-on-one assistance
• Most of the videos will cover Bloom’s Taxonomy levels for **remembering** and **understanding**
• Class time can be spent **applying** what students are learning

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**Blooms Taxonomy**

*Traditional Model*
- Students are responsible for homework in these levels of understanding
- Teachers introduce new material to students.

*Flipped Model*
- Students and teachers work together during the school day on these levels of learning.
- New material is introduced to students outside of class as their homework.

**You to spend more time teaching at the upper levels**
The Flipped Classroom

\[ \text{C} \quad \frac{6.256 \, \text{g}}{1\, \text{mol}} = \frac{0.521}{125} \times 125 = 1 \]

\[ \text{H} \quad \frac{1.392 \, \text{g}}{1\, \text{mol}} = \frac{1.392 \, \text{mol}}{125} = 0.011 \]

\[ \text{O} \quad \frac{8.352 \, \text{g}}{1\, \text{mol}} = 0.082 \]
Why Flip the Class?

• Can be used in conjunction with other high-impact methods, such as supplemental instruction and peer tutoring \(^3\)\(^4\)
• Allows for student-student and student-instructor interaction during class time
  – Particularly important for students in service courses\(^5\)
  – Can help to improve students’ perceptions about their “ability” to do math \(^6\)

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Snap-shot of our students
## Students and Multi-Media

Among all 8- to 18-year-olds, average amount of time spent with each medium in a typical day:

<table>
<thead>
<tr>
<th>Medium</th>
<th>2009</th>
<th>2004</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV content</td>
<td>4:29a</td>
<td>3:51b</td>
<td>3:47b</td>
</tr>
<tr>
<td>Music/audio</td>
<td>2:31a</td>
<td>1:44b</td>
<td>1:48b</td>
</tr>
<tr>
<td>Computer</td>
<td>1:29a</td>
<td>1:02b</td>
<td>:27c</td>
</tr>
<tr>
<td>Video games</td>
<td>1:13a</td>
<td>:49b</td>
<td>:26c</td>
</tr>
<tr>
<td>Print</td>
<td>:38a</td>
<td>:43ab</td>
<td>:43b</td>
</tr>
<tr>
<td>Movies</td>
<td>:25a</td>
<td>:25ab</td>
<td>:18b</td>
</tr>
<tr>
<td><strong>TOTAL MEDIA EXPOSURE</strong></td>
<td>10:45a</td>
<td>8:33b</td>
<td>7:29c</td>
</tr>
<tr>
<td>Multitasking proportion</td>
<td>29%a</td>
<td>26%a</td>
<td>16%b</td>
</tr>
<tr>
<td><strong>TOTAL MEDIA USE</strong></td>
<td>7:38a</td>
<td>6:21b</td>
<td>6:19b</td>
</tr>
</tbody>
</table>

– Kaiser Family Foundation, 2010

http://kaiserfamilyfoundation.files.wordpress.com/2013/04/8010.pdf
Speak Up 2014 National Research Project Findings

For the third consecutive year, 4,326 building and district administrators from **2,600 school districts** are seeing a **significant increase in teachers flipping their classrooms** using videos they have found online or that they are creating themselves. Over the past three years, school leaders at all grade levels have seen increases from **23 to 32 percent of teachers** using videos found online, with a slightly larger overall increase in the number of teachers who are creating their own videos moving from **19 to 29 percent**.
Of 180,000 middle and high school students: Almost 75% agreed Flipped Learning would be a good way to learn. 60% use online and teacher-created videos as part of their learning process.
The Students

- To students...computers aren’t technology
- Multi-Tasking is a way of life!
- Going to an electronic device is a common experience for students
Advantages of the Flipped Classroom
Advantages of the Flipped Classroom

- Students can review as many times as needed
- Students can work at their own pace
- Students could learn at home or school
- Students are less anxious during class
- I have more time to personalize communications with students
Advantages of the Flipped Classroom

- A means to **INCREASE interaction** and personalized contact time between students and teachers.
- An environment where **students take responsibility** for their own learning.
- Students **who are absent** or involved in extracurricular activities do not get left behind.
- A class where content is permanently archived for review or remediation.
- A class where **students are engaged** in their learning.
- What used to be class work (lecture) is done at home and what used to be homework (assigned problems) is now done in class.

Disadvantages of the Flipped Classroom
Disadvantages of the Flipped Classroom

• Production Time
• Student (Parent, Administrator) Buy-in
• Access
• Storage
• Homework – What if students do not complete online videos
• Students cannot ask questions during the recorded video
The Flipped Classroom is NOT:

- Just online videos
- About replacing teachers with videos
- An online class
- Students working without structure
- Students working in isolation
- Students spending the entire class online
Flipped Course Features

Online Modules

Ticket in the Door

Mathematics Labs
Where to begin

1. Determine a goal you would like to achieve in your teaching and/or your student’s learning.

2. Develop an instructional strategy to accomplish your goal.

3. Select an element of the technology that can be used for this strategy.

4. Identify the skills in the use of a technology that you need to develop in order to implement the strategy.
Instructional Script

Date

Unit Title       When Lines Meet: Linear Systems

Section         3.1 Interpreting Intersection Points: Linear and Nonlinear Systems

Students completing this section will be able:

- Explain why the x-coordinates of the points where the graphs of the equations \( y = f(x) \) and \( y = g(x) \) intersect are the solutions of the equation \( f(x) = g(x) \); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where \( f(x) \) and/or \( g(x) \) are linear.
- Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions.
Online Module File Name  Section 3.1 Solving Systems (Graphing)

Online Modules

*Section 3.1 When Lines Collide: Solving Systems by Graphing*
Students will Solve Systems of Linear Equations Using Graphing
Students will discover when systems have one, none and infinitely many solutions and the geometric description of such instances

**Ticket in the Door**

*Section 3.1 When Lines Collide: Solving Systems by Graphing*
Students are to list the objectives of the module
Students are to solve several systems of equations using graphing.

**In class discussion**

Section 3.1 Pages 63 - 65 Great Examples
Focus: Meaning of the intersection of functions
Online Modules?
Online Modules – Free Resources

http://www.phschool.com/atschool/  Pearson Textbook Resources

Flipped Classroom Workshop.com  http://www.flippedclassroomworkshop.com

Youtube

Teacher Tube

Hippo Campus – an online collection of lessons associated with HS science and math courses

PHET Simulations – a collection of interactive science simulations (most are physics based)

Khan Academy – online lectures on a myriad of topics

MIT Open Courses – online lectures from MIT professors (more appropriate for AP courses)

ThePhysicsClassroom – site with tutorials, problem solving help and simulations
Online Modules – Create your Own

**AContent** (free)
Adobe Captivate ($) 
Adobe Presenter ($) 
**Articulate Presenter** ($) 
**Articulate Quizmaker** ($) 
**AuthorPoint** ($) 
**Composica** ($) 
**CourseBuilder** ($) 
**CourseLab** (free, $) 
**EClass.Builder** (free) 
**eLML** (free) 
**Flair** ($) 
**Hot Potatoes** (free) 
iSpring Presenter ($) 
**LERSUS easyContent** ($) 

**LodeStar** ($) 
**Melete Lesson Builder** ($) 
**Momindum Studio** (free, $) 
**MOS Solo** (free) 
**Multimedia Learning Object Authoring Tool** (free) 
**Pachyderm** (free) 
**ProForm** ($) 
**Reload Learning Design Editor** (free) 
**SoftChalk Create** ($) 
**Sophie** (free) 
**SumTotal ToolBook** ($) 
**Trident** ($) 
**Udutu Course Authoring** (free) 
**WBTExpress** ($) 
**WimbaCreate** ($) 
**WonderShare QuizCreator** ($) 
**Xerte Online Toolkits** (free) 
**XML SCORM Studio** (free)
Online Modules?

showme.com  educreations.com

softchalk.com
For editing: zaption.com
Online Modules

- Adobe Captivate

SCORM

+ 

Course + LMS = Tracking
Online Modules

Math 115 – College Algebra
Section 3.1 When Lines Collide
Ticket in the Door

Section 3.1 When Lines Collide: Solving Systems by Graphing
Ticket in the Door

In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

What are the objectives this module?

Check your understanding:

1. Solve this system of equations by sketching the graphs and estimating the solution.
   \[3x + 2y = 7\]
   \[4x - 4y = -4\]

2. Estimate the solution of the system pictured.

3. Determine whether \((-5, -3)\) is a solution to the following system.
   \[y = 7 + 2x\]
   \[y = -23 - 4x\]

SECTION 3.1 WHEN LINES COLLIDE: SOLVING SYSTEMS BY GRAPHING
Ticket in the Door

- **Pre-Assessment**
- Once student earn at least 75% accuracy on the online modules, they are given access to the ticket in the door.
- Students are to turn the ticket in the door immediately upon arriving to class
- Feedback is given and returned the next class period
- Each student has the opportunity to present the ticket to the class
Mathematics Labs

- Student-Centered
- Actively Engaged
- Groups of 4 – 6
- Students Present Word-Problems
Example. The following table shows costs for these systems for a typical house.

<table>
<thead>
<tr>
<th>Type of System</th>
<th>Installation Cost ($)</th>
<th>Operation Cost/Year ($)/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>5,000</td>
<td>1,100</td>
</tr>
<tr>
<td>Gas</td>
<td>12,000</td>
<td>700</td>
</tr>
<tr>
<td>Solar</td>
<td>30,000</td>
<td>150</td>
</tr>
</tbody>
</table>

A solar system is the most expensive to install but the least expensive to operate, while electric is the cheapest to install but the costliest to run.

Let \( n \) equal the number of years of operation. Find linear models for the total cost, \( C \), of each of these heating systems.

Summarize your conclusions. If cost is the only issue, how would you decide between a gas or an electric heating system?
College Algebra as a Bottleneck

• CSU Chancellor’s “Course Redesign with Technology” in April 2013
  – System-wide initiative to reduce bottlenecks (high enrollment, low success)
  – 22 courses identified

• College algebra at the forefront of these
  – Nationally: Largest enrollment of any credit bearing mathematics course
  – National failure/withdrawal rate in 40-60% range

1. http://www.course redesign.csuprojects.org
College Algebra at CSUF

- CSU Fullerton: 38,000 students, urban setting
- “Math 115” = College Algebra
  - Strong focus on “word problems” and modeling
  - Standardized assessment: 4 exams and final, all common across sections
- Average pass rate traditionally ≈ 60%
- 2012-2013 AY: 30% repeatable grades (C- or lower)
- Minimal selection bias: no indication of a flipped course during enrollment
### Pilot – Spring 2014 Data

#### Achievement Results

**Comparing Mean Scores**

<table>
<thead>
<tr>
<th></th>
<th>Exam 1*</th>
<th>Exam 2</th>
<th>Exam 3*</th>
<th>Exam 4*</th>
<th>Final Exam*</th>
<th>Semester Grade*</th>
<th>Repeatable grades</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flipped</strong></td>
<td>78%</td>
<td>72%</td>
<td>60%</td>
<td>71%</td>
<td>60%</td>
<td>72%</td>
<td>34%</td>
</tr>
<tr>
<td>(n = 127)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lecture</strong></td>
<td>69%</td>
<td>71%</td>
<td>50%</td>
<td>64%</td>
<td>54%</td>
<td>65%</td>
<td>43%</td>
</tr>
<tr>
<td>(n = 524)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On average, students in the flipped classes earned semester grades 7% higher than those in the traditional classes.

*Statistically significant difference, $\alpha = .01$ or better

National failure/withdrawal rate in 40-60% range.²
Pilot – Spring 2014 Data

Semester Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Flipped First Time</th>
<th>Repeating 115</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74.00%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Flipped: 73.30%
- Repeating 115: 66.40%

- Flipped: 71.0%
- Repeating 115: 63.60%

115 First Time vs. Repeating 115
Study was repeated during Fall 2014 semester
- Lecture Class (n = 1322)
- Flipped class (n = 305)

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Flipped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing Grades</td>
<td>69.9% (924)</td>
<td>78.4% (239)</td>
</tr>
<tr>
<td>Repeatable Grades</td>
<td>30.1% (398)</td>
<td>21.6% (66)</td>
</tr>
</tbody>
</table>

Flipped: 34% → 21.2%
Lecture: 43% → 30.1%
13% decrease
Future Work

• MTDP Pre-and-post questions
• Pre-and-post test method to measure student engagement
  • Survey tool: Questions from 2012 PISA Student Beliefs survey\(^7\) and additional questions from researchers
• How they performed in their current course?
• Continued implementation of flipped math classes (pre-calculus, calculus for business, math for liberal arts) and assessment of flipped class vs. traditional
• Currently piloting pre-calculus (very similar in terms of lecture vs. flip class conditions) at CSUF
Fall 2014 Student Feedback

I loved the modules. They helped me a lot, they were a great way of studying. I felt I got "one-on-one" attention even though it wasn't with a real life professor.

I like the ticket in the door because I do math everyday and I get feedback.

I like that we can spend more time in class working on word problems.

I like the modules a lot because it helps with my visual learning needs and I can just focus on the lesson without the worry of keeping up with writing notes in class.
I really liked the modules, it let us **go over the topic before class** and then in class go more in depth.

The **modules were very consistent and were an essential key to passing the class.** The pacing **felt slow sometimes** but it turned out better in the end.

The online modules were very helpful. I like that we **could rewind and watch over again**, unlike a normal class lecture.
Instructor Reactions

I no longer feel pressured for time; the ultimate responsibility for pacing is the students'.

I spend **less time passively lecturing**, but rather engage in an active discussion with all students.

Students are responsible for a “piece of a larger puzzle” even when working in groups.

The students are given an opportunity to **practice in class**, learn from each other, and catch common errors.

After each class period, I can say **I have checked-in with each student**.

Students who are absent **no longer get left behind**.
Questions

cichinose@fullerton.edu
e-Resources for the Flipped Classroom

The Flipped Class: Myths vs. Reality

Are You Ready to Flip?

The Flipped Class: Students Talk

The Flipped Class Revealed