The Inverted Classroom: A Model for Any Discipline

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Outline
I. The Traditional Classroom
II. The Inverted Classroom
III. What do we do in class?
IV. How does the teacher make this happen
V. Evidence of effectiveness
VI. Student feedback

THE TRADITIONAL CLASSROOM

Traditional Class
1. Come to class and listen to lecture and take notes.

Traditional Class
2. Some time allowed for class work and questions.
Traditional Class

3. Go home and attempt the homework (probably get stuck on the more difficult problems)

4. Come to class and perhaps there is time to go over a couple of questions

5. The class moves on to a different section. If you were lost, you had to get caught up.

The Inverted Classroom

- An inverted class takes events that used to take place outside of the classroom (e.g. homework), are now done in the classroom, while things traditionally done during class (e.g. the lecture) are done outside of class.

Valuable time together

- Most important time together?
  - When students have questions
- When does this occur?
  - when listening to a lecture?
  - When trying to apply the principles?
### Lecture vs. Process

<table>
<thead>
<tr>
<th>Class Time</th>
<th>Lecture-based teaching</th>
<th>Process-based teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Exposure</td>
<td>(Students first hear or observes facts, ideas)</td>
<td>Process (student applies, analyzes, argues, solves problems using first-exposure material)</td>
</tr>
</tbody>
</table>

| Student Study Time  | Process | First exposure (Video Lectures) |

(Walvoord, 1998)

### The Inverted Class

1. Watch a video lecture before class

2. Take video lecture quiz*

3. Do a few online homework problems

### The Inverted Class

3. Do a few online homework problems
The Inverted Class

4. Print the concept workshop and bring to class.

Summary

Students will do the following:

1. Watch video lecture BEFORE class.
2. Take video lecture quiz*
3. Do a few online homework problems
4. Print the concept workshop and bring to class.

When students come to class, they will form groups and work on the concept workshop.

*not for every course

First Experience Homework

How to get students to come to class prepared

◦ Created video lectures using Camtasia and a Tablet PC
◦ Required them to do a few problems from MML
◦ Embed quizzes in the videos. (Or do a 1 question VL Quiz.)
◦ Go around and review their notes.

WHAT DO WE DO IN CLASS?

• Concept workshop
Concept Workshops and in-class activities

- **Example 1** (College Algebra—Linear Functions)
- **Example 2** (College Algebra—Quadratic Functions)
- **Tell me what you know**—Quad/Rational

**Stats Activity 1** (M&Ms)
**Stats Activity 2** (Sampling Variability-computer sim)
**Stats Activity 3** (Ghostbusters-video)

What we do in class

- Concept workshop
- Graded Boardwork (**Rubric**)

Activities

- “Regression on the Rebound”
What we do in class

• Concept workshop
• Graded Boardwork [Rubric]
• Activities
• Projects/Presentations

Projects/Presentations

• Project
• Example Presentation: 
  – Race Walking

What we do in class

• Concept workshop
• Graded Boardwork [Rubric]
• Activities
• Projects/Presentations
• Math in the movies

Math in the Movies

The wizard of oz [IMDb link]
The sum of the three angles in an isosceles triangle is the square root of the sum of the squares of the sides. (Thanks to Wilby Pickle’s [One More Episode])

23 [IMDb link]
A true story about German Hackers/Wilby. Numerology in the movies. (The main character)

What we do in class

• Concept workshop
• Graded Boardwork [Rubric]
• Activities
• Projects/Presentations
• Math in the movies

Textbook Activities

Collaborative Corner

Step-by-Step Solutions

Problem: Solving linear equations
Time: 20 minutes
Group size: 3

In general, there is more that one correct sequence of steps for solving an equation. This makes it important that you write your steps clearly and logically so that others can follow your approach.

Activity

1. Each group member should select a different one of the following equations and on a fresh sheet of paper, perform the first step of the solution.

   \[4 - 7x - 3x = 5x + 62 - x\]
   \[3 - 7(x - 3x - 5) = 3x + 4(2x - 3) + 9\]
   \[4x - (2x + 3x - 5) + 3x - 4x - (6x - 3x - 9)\]

2. Pass the papers around so that the second and third steps of each equation are performed by the other two group members. Before writing, make sure that the previous step is correct. If a mistake is discovered, return the problem to the person who made the mistake for repairs. Continue passing the papers around until all equations have been solved.

3. Each group should make a consensus on what the three solutions are and then compare their answers to those of other groups.
What we do in class

- Concept workshop
- Graded Boardwork (Rubric)
- Activities
- Projects/Presentations
- Math in the movies
- Textbook Activities
- Interactive Java Applets

**Advantages**

- Interacting with students (what we like best!)
  - Can spot struggling students, who are more comfortable asking questions
  - Students can get immediate feedback

**Advantages**

- No strict time limit for covering material
Advantages

• Students work at own pace
• More like an “expected” pace.

Advantages

• Students engaged with other students — Reinforces concepts when talking about it

Advantages

• Releases instructor from the “tyranny of the content.” (Bowen)

Advantages

◦ Can spend a greater proportion of class time doing the critical thinking and actively analyze/synthesize problems that are based on the assigned videos.
◦ Class time is used mostly for the “Processing” part of learning (Walvoord, 1998).

Disadvantages/Issues

• Getting students to come prepared
• Time
• Bandwidth/Plug-ins
• Scapegoat for the unsuccessful
• If they replay the video, they get the same explanation
• Questions are delayed until class time
• Strange conversations

HOW DOES THE TEACHER MAKE THIS HAPPEN

Students are now responsible for their first experience learning outside of class; this in fact is their homework.
The process

1. Identify the learning outcomes for the course. You should have at least 1 per section.

2. Create the in-class “experience.”

Learning Outcomes

- Example: Students will demonstrate the ability to solve linear equations, inequalities, and compound inequalities, and to represent solutions in set, interval, and graphical notations.

In-class Experience

- This in-class experience may include the following:
  - Concept workshop
  - Graded Boardwork (Rubric)
  - Activities
  - Projects/Presentations
  - Math in the movies
  - Textbook Activities
  - Java applets

In-class Experience

- Align the in-class experience with the learning outcomes.

The process

1. Identify the learning outcomes for the course. You should have at least 1 per section.
2. Create the in-class “experience.”
3. Create the out-of-class “experience.”
Out-of-class Experience

• Can include:
  – Video Lecture
  – Reading
  – Java applet exploration
  – Working through some basic problems

The Video Lecture

• Camtasia
  – Allows one to easily add audio and publish as SWF/mp4
  – Can be used with Tablet PC to easily audio-annotate.
  – Example 1 (CA 2.1) | Example 2 (CA 3.1) | Example 3 (CA 8.3)
  – Live Video (next slide)

Live Video

EVIDENCE OF EFFECTIVENESS

Quick Look a the Research

• Biology: UC Irvine. Students in the inverted class had a higher improvement on final exam scores (p < .001) than the non-inverted counterparts. (Moravec, Williams, Aguilar-Roca, O’Dowd, 2010)

• Software Engineering: Miami University of OH; students showed strong self-ratings of their ability to write application of software at high-levels of engagement.

Quick Look a the research

• Math: Students in a Linear Algebra course who were exposed to an inverted format had significantly higher success rates on final exam problems than the in-class lecture students (Talbert, 2012).

• Intro Economics: Seminal work where the authors note that the inverted format allows an instructor to present a variety of learning options while maintaining control over course content. (Lage et al. 2000)
Quick Look a the research

- **Music**: Bowen (2006) recommended removing the recitation of content (the lecture) from the classroom.

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Student reactions

“I think that it not only gives the students an opportunity to take responsibility to learn on their own but gives the teacher time to explain the trouble problems in class. I love the method!” —Anonymous student 1530 Fall 2007

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Student reactions

“I think it's an excellent way to do a math course because you don't need help with listening to the lecture, but you do need help applying the concepts and working through the problems. I believe if the class he been done as a traditional course is taught then it would've been much more difficult to learn the subject matter.” —Anonymous student 1530 Fall 2007

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Student reactions

“I loved it. I learned very well that way because you can rewind the video and you can take as long as it takes you to get it. But in class you cannot rewind what the teacher just said and you have a limited amount of time to go over everything.” —Anonymous student 1010 Fall 2007

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Student reactions

“I think that it was awesome!! I have never been able to comprehend math until it was taught this way.” —Anonymous student 1010 Fall 2007

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Student reactions

“It was so fabulous that I sold everything I owned to become a stats teacher and follow in Dr. McD’s footsteps.” —Nobody...yet!
Right for you?

- Do you already have a highly interactive class where students come prepared?
- Does your course content change often?
- If you don’t lecture during class, are there activities you can do in the classroom that will engage the student?
- Do you already have content in a digital format?

Online format

- I use www.coursecompass.com (MyMathLab), but you could use any LMS (e.g. Blackboard, D2L, Moodle)
- If time allows, you will be shown how this is set up in coursecompass
- Teaching Naked (or just Google “NPR Teach Naked”)

Useful Links

- http://mast.unco.edu/programs/vodcasting/
- http://vodcasting.ning.com/
- http://www.ted.com/talks/salman_khan_let_s_use_video_to_reinvent_education.html
- http://projecteuler.net/
- http://khanacademy.org/
- http://lbvodcasting.com/

References and Software


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References

- Talbert, Robert (2012) "Inverted Classroom," Colleagues: Vol. 9: Iss. 1, Article 7. Available at: http://scholarworks.gvsu.edu/colleagues/vol9/iss1/7

References and Software


Software/Hardware Used

- **Software**
  - Camtasia Studio, SnagIT, Winplot, Virtual TI
- **Hardware**
  - Tablet PC (Gateway and Dell)
  - Blue Snowball Microphone

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