The Inverted Classroom: A Model for Any Discipline

By Dr. Scott McDaniel
Middle Tennessee State University
smcdanie@mtsu.edu
MrMathTutor.wordpress.com

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 Classroom
- Open

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)

THE INVERTED MODEL

Traditional Class

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

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.

Traditional Class

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

Why
Valuable time together

Most important time together?
- When students have questions
- When listening to a lecture?
- When trying to apply the principles?

Lecture vs. Process

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

(Walvoord, 1998)

The Inverted Class

1. Watch a video lecture before class

The Inverted Class

2. Take video lecture quiz*

The Inverted Class

3. Do a few online homework problems

WHAT THE STUDENTS DO BEFORE CLASS
The Inverted Class

3. Do a few online homework problems

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?

What 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)

Boardwork?
What we do in class

• Concept workshop
• Graded Boardwork (Rubric)
• Activities

Projects/Presentations

• Project
• Example Presentation: Race Walking

Activities

• “Regression on the Rebound”

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

A true story about German

23 [IMDb link]
What we do in class

• Concept workshop
• Graded Boardwork (Rubric)
• Activities
• Projects/Presentations
• Math in the movies
• Textbook Activities

Advantages

• Students can pause/rewind the lecture as often as needed
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 engaged with other students
  - Reinforces concepts when talking about it

Advantages

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

Advantages

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

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

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

**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.

**HOW DOES THE TEACHER MAKE THIS HAPPEN**

**The process**

1. Identify the **learning outcomes** for the course. You should have at least 1 per section.
2. Create the in-class “experience.”

**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 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 (Stats Normal) | Example 3 (CA 8.3)
  - Live Video (next slide)

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

EVIDENCE OF EFFECTIVENESS
Quick Look at 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.

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?

Quick Look at 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)

Suggestions

- Don’t try to flip your entire class for next term. Just pick 3-4 lessons to flip.
- Feel free to use outside content (e.g. http://ed.ted.com)
- Don’t make the outside content too time consuming in the beginning.

Quick Look at the research

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

Get in groups (or at least in pairs)

Now with your group, discuss how you might be able to use the inverted model in your classes. Can you think of 1-2 topics that you could “flip” and have students’ first exposure to the material come BEFORE class. What challenges do you foresee?
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

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

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

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”)

““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

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

• http://mast.unco.edu/programs/vodcasting/
• http://vodcasting.ning.com/
• http://www.ted.com/talks/salman_khan_let_s_u se_video_to_reinvent_education.html
• http://www.mathpickle.com/K-12/Videos.html
• http://projecteuler.net/
• http://khanacademy.org/
• http://ibvodcasting.com/

References and Software


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

Contact

- Dr. Scott McDaniel
- [Scott.mcdaniel@mtsu.edu](mailto:Scott.mcdaniel@mtsu.edu)
- [www.Mrmathtutor.wordpress.com](http://www.Mrmathtutor.wordpress.com)