# Teaching Electrical Engineering (EE) to non-EE majors in blended (flipped) classroom: Creation of the *flow* experience in online Self-Assessments

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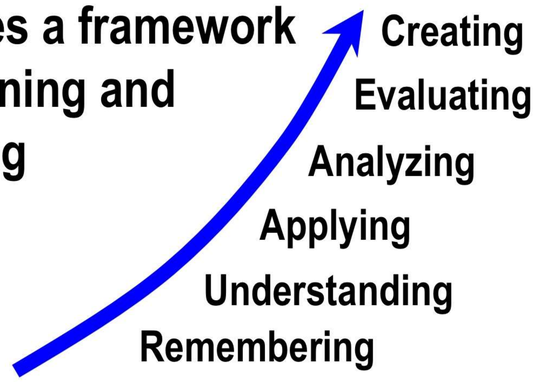
EECS ECE CSE

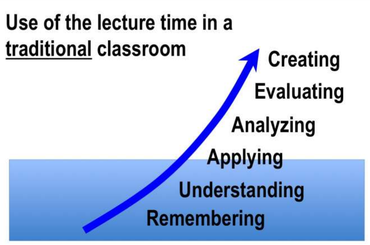
## Theoretical perspective

**The Bloom's taxonomy provides a framework for learning and teaching**

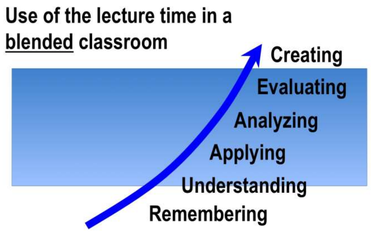



(After Bloom, 1956; Andersen & Kratwohl, 2001)

## What's blended classroom?




Applying, etc. is expected to be done by the students **after** the lecture




Remembering and Understanding are expected to be done by the students **before** the lecture

**Before lecture**, students read and complete online Self-Assessments on the Readings.

Opportunities **in the blended lecture** include:

- ✓ Conceptual questions
- ✓ Peer instruction (after Eric Mazur)
- ✓ Mini-lectures on the hardest topics
- ✓ Demonstrations of real experiments

## Self-Assessments vs. HW

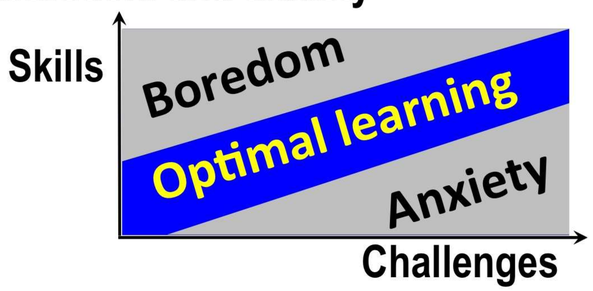
| Learning via Self-Assessments | Learning via Homework |
|---|---|
| • Student receives **immediate feedback** | • Student received **delayed feedback** (graded paper) |
| • Momentarily after submission, **the student receives reassurance/guidance** on the way to mastery | • At the time of submission, **the student does not receive reassurance** on whether he/she mastered the material |
| • The feedback arrives when **the student is still thinking** about the particular problem | • The feedback arrives after **the student has long forgotten** about the particular problem |
| • **The feedback includes** a complete solution = **example of winning stragegy** | • The **feedback only highlights student's errors** but does not show how to correct them |
| • The student is given **3 tries to solve problems** on the given topic, without penalty | • There is **no second attempt** to solve a HW problem and still get credit for it |

## The *flow* experience

**Pre-requisites for the optimal performance:**

- **Specific goals**
- **The level of challenge matches the skills**
- **The feeling of being in control**
- **Immediate feedback**

**The optimal conditions for learning are between boredom and anxiety**




(After Csikszentmihalyi, 1975, 2014, etc.)

## What's for the instructor?

### Advantages

**Before the lecture**

- ✓**Monitor students' questions** (via CTools' Forums, etc.)
- ✓**Obtain a complete update** (via CTools' Gradebook, etc.) on how the students have mastered the material (for this lecture)

**During the lecture**

- ✓**Do not worry** about "covering all the material"
- ✓Instead, focus on the most difficult parts, to **help the students learn**
- ✓**Foster student learning** by asking conceptual questions
- ✓**Enjoy the freedom:**
  - ❑ Discuss interesting applications
  - ❑ Explain connections between different parts of the course
  - ❑ Relate theory to experiments via demonstrations

### Requirements for success

**Before the lecture**

- ✓ Create materials for Self-Assessments (a huge investment of time)
- ✓ Invest time in answering students' questions online
- ✓ Prepare materials for interactive learning during the lecture time

**During the lecture**

- ✓ Be prepared to answer students' questions
- ✓ Monitor the students' engagement in problem-solving activities
- ✓ Go beyond the "pre-cooked" presentations

## Changes & Challenges

### Changes

- ✓ **Pre-Labs online:** Theoretical questions are offered **online** but hands-on questions (show how you will build the circuit, etc.) are still done **on paper**
- ✓ **Self-Assessments and Homework:** SA cover the lower 2 levels of the Bloom's taxonomy; Homework targets the higher levels
- ✓ **Homework becomes shorter**, because students cover lower levels in SA
- ✓ **The grading scheme is changed:** Rewards for SA and participation lead to reduced cost of the exams; the scores for SA "saturate at the top"

### Challenges

- ✓ Very robust, sustainable, and reusable online repository for Question Pools and Self-Assessments is necessary; CTools are not perfect
- ✓ How to assess the effectiveness? Are we fostering intrinsic motivation?
- ✓ Do students get the *flow* experience?

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