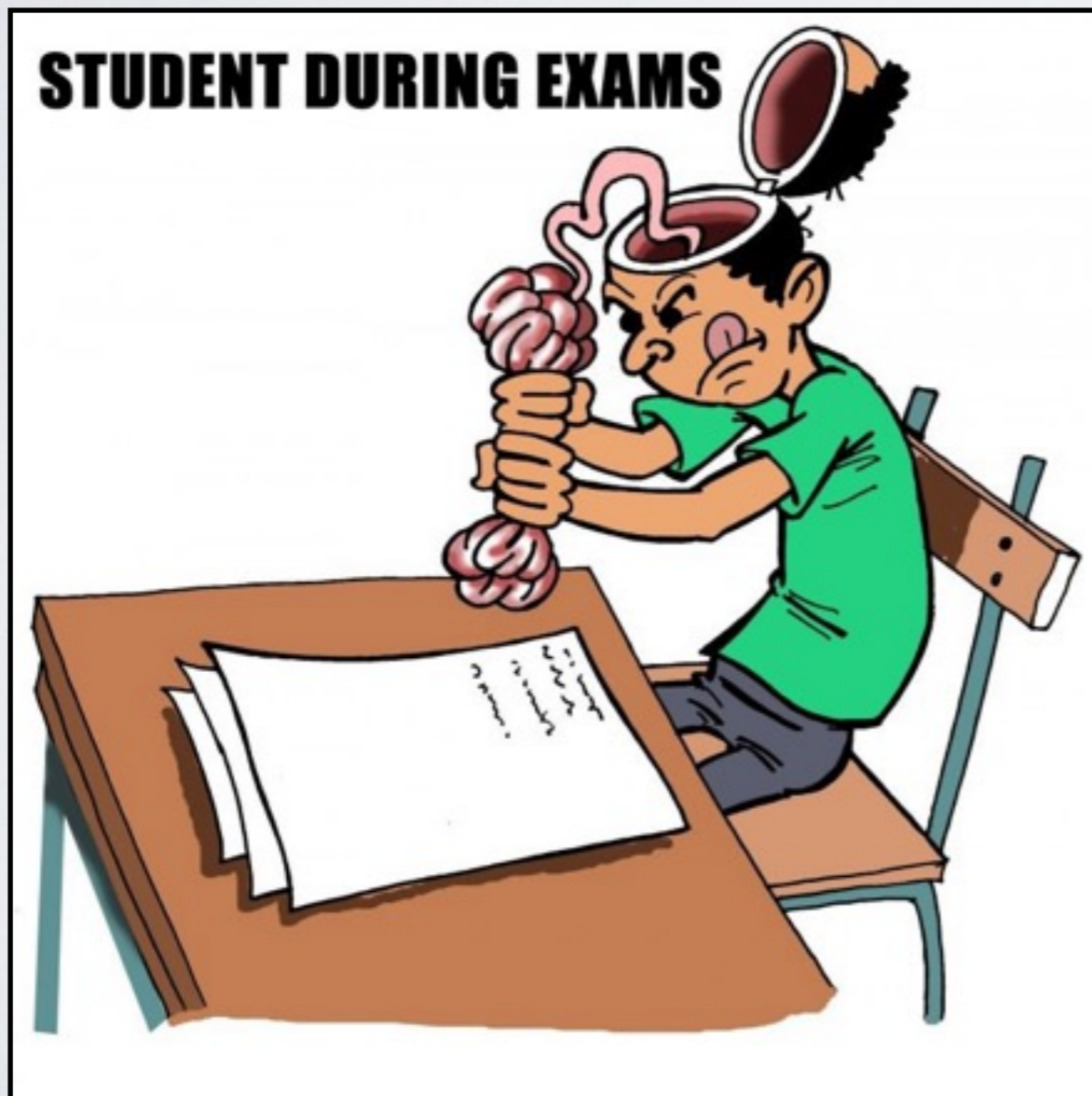


Two-Stage Exams: Turning Exams Into Learning Opportunities



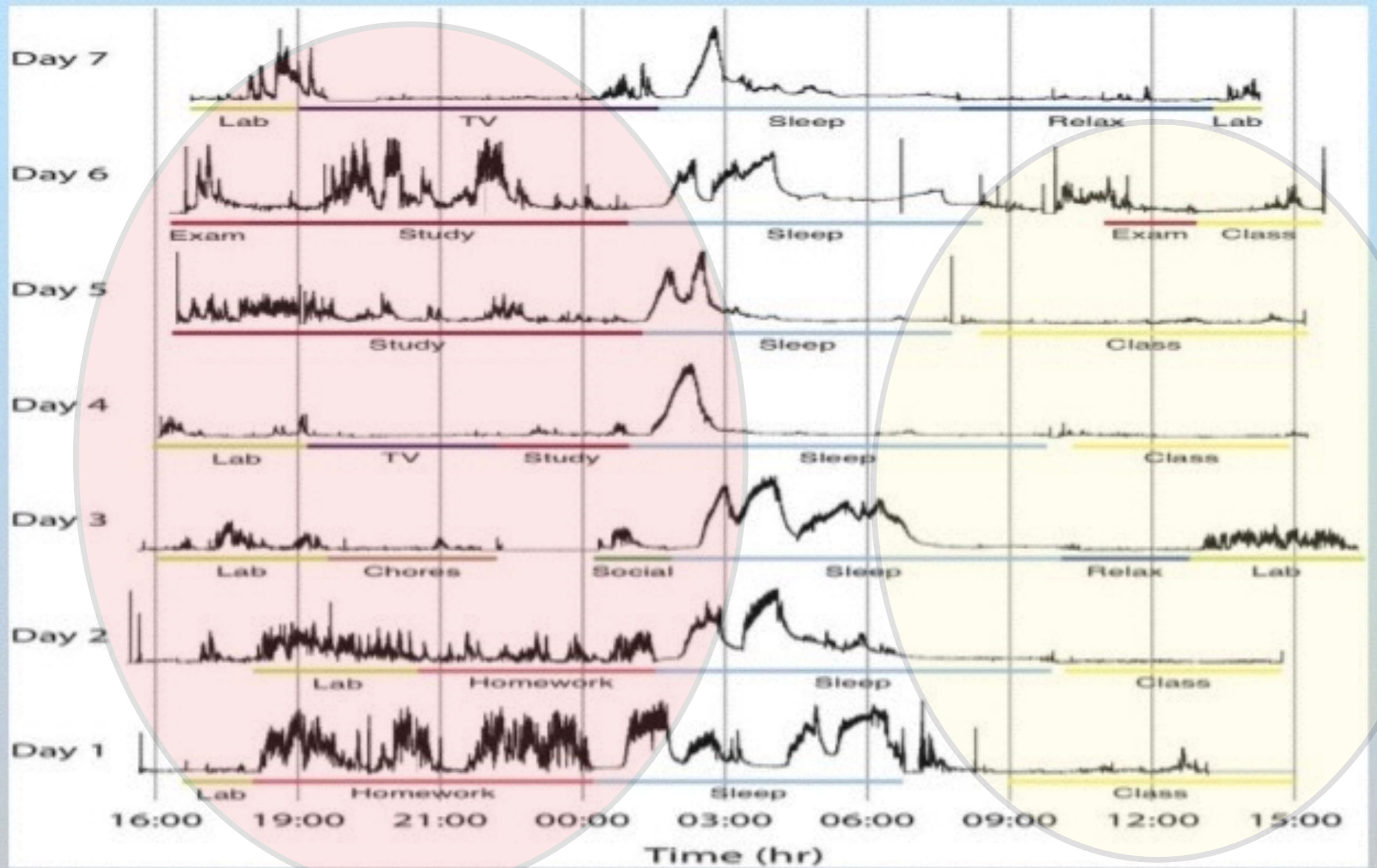
Vincent Bouchard





“Tell me and I forget,
teach me and I may remember,
involve me and I learn.”

-Benjamin Franklin



THE BLENDED LEARNING AND FLIPPED CLASSROOM IDEA

- Present (most of) the core material online to the students **before** class (videos, readings, etc.)
- Spend (most of) class time **working on problems**

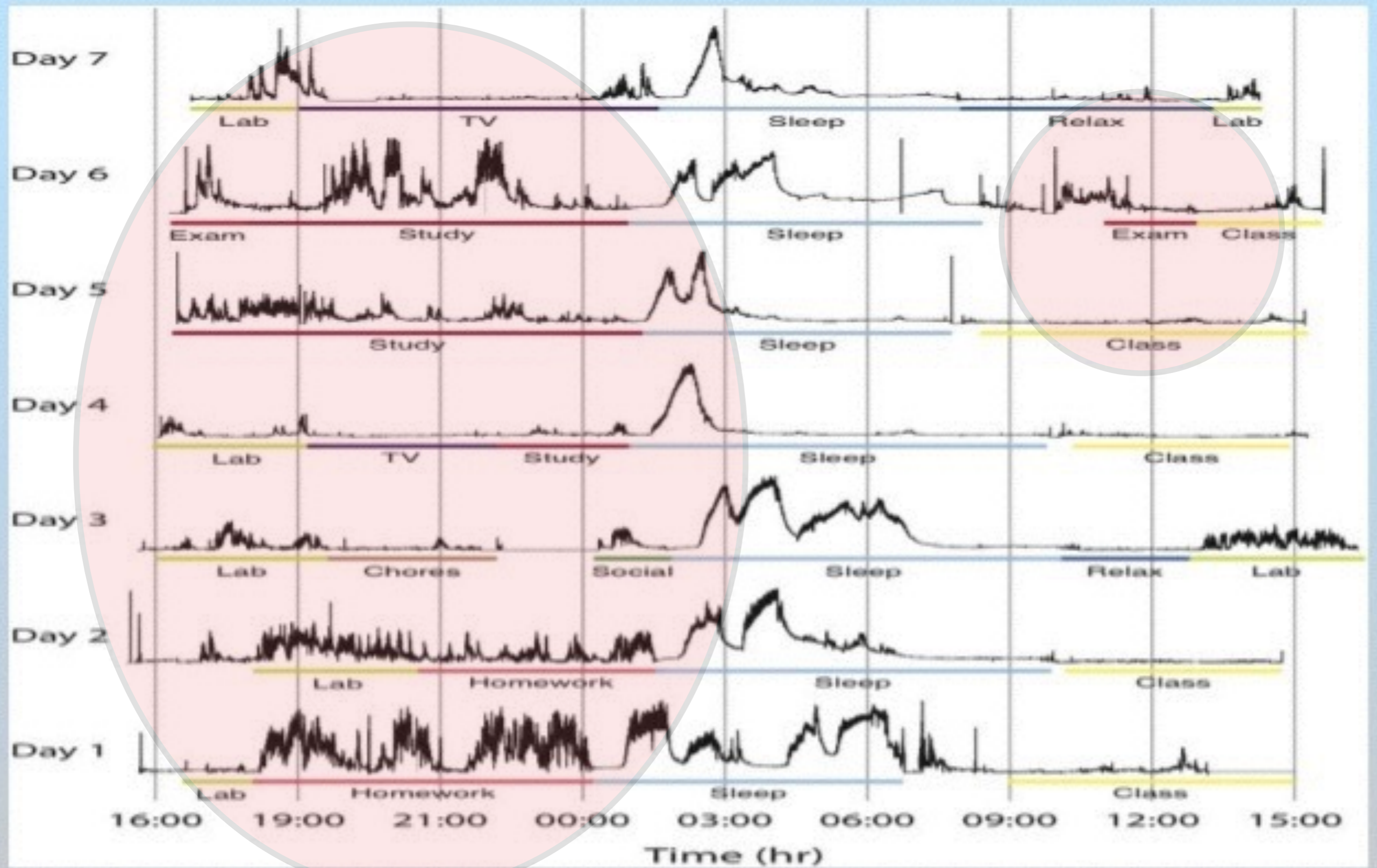
THE PILOT PROJECT: 2014-2015

Two courses:

1. **Math 114** (Calculus I) in Fall 2014
2. **Math 115** (Calculus II) in Winter 2015
 - Special section for students also taking the introductory physics sequence (PHYS 144 and PHYS 146)
 - About 100-120 students in the section
 - The full year was **fully blended and flipped**

But... how do exams fit in this blended/
flipped pedagogical approach?

- Exams are meant to **assess** how students understand the material
- But exams should also be a **learning opportunity** for students



Students are already engaged and active during exams.

The problem is more about retention:



How can we make sure that students do not forget everything that they studied before exams?

Typical exam scenario:

- Student studies a lot before (mostly the night before) the exam
- Student comes to class, performs the exam under time pressure, then leaves
- Student receives back her/his graded copy a couple weeks later with perhaps a few comments on her/his mistakes

Problem:

By the time the student receives back her/his copy, he has forgotten about the material in the exam! In fact she/he may not even look at her/his copy before the next exam a month later!

TWO-STAGE EXAMS

- **First stage**: standard individual exam (say 2h)
- **Second stage**: the students redo the same exam, but in groups — one copy per group (say 1h)

Marks:

$80\% \times (\text{individual}) + 20\% \times (\text{group})$

or

$100\% \times (\text{individual})$ if better

- In the second (group) stage, students receive **immediate feedback** on their solutions
- Good example of **peer learning**, which turns exams into a much better **learning opportunity** for students
- So nice to see students **actively engage in math** and **debate** with each other!



FROM AN ASSESSMENT VIEWPOINT

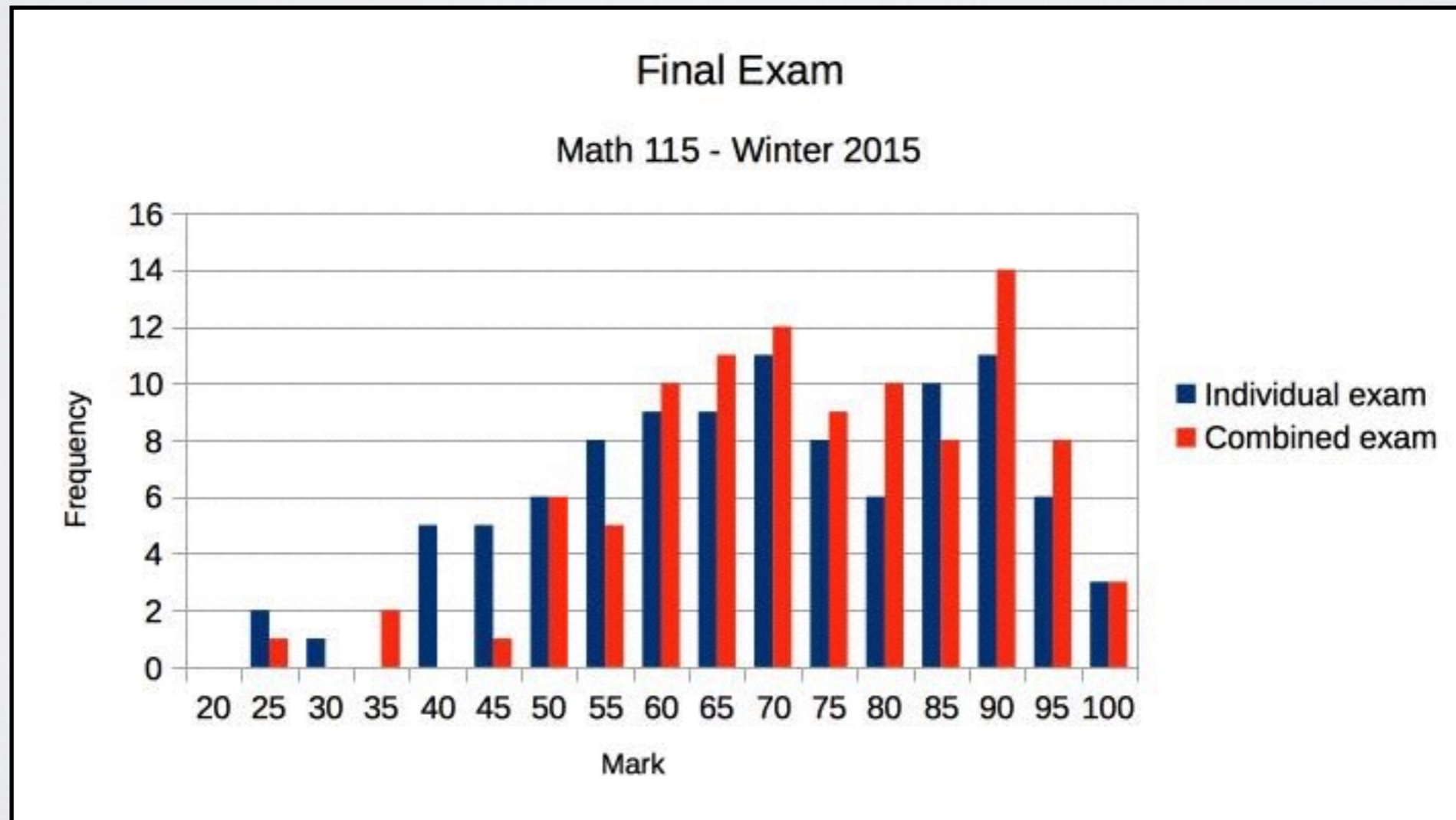
- Raises the class average by about 3-4%
- The weaker students are those whose marks are raised the most (but are also those that benefit the most from immediate feedback and peer learning)

Final exam, Math 115 - Winter 2015:

Individual average: 66.9%

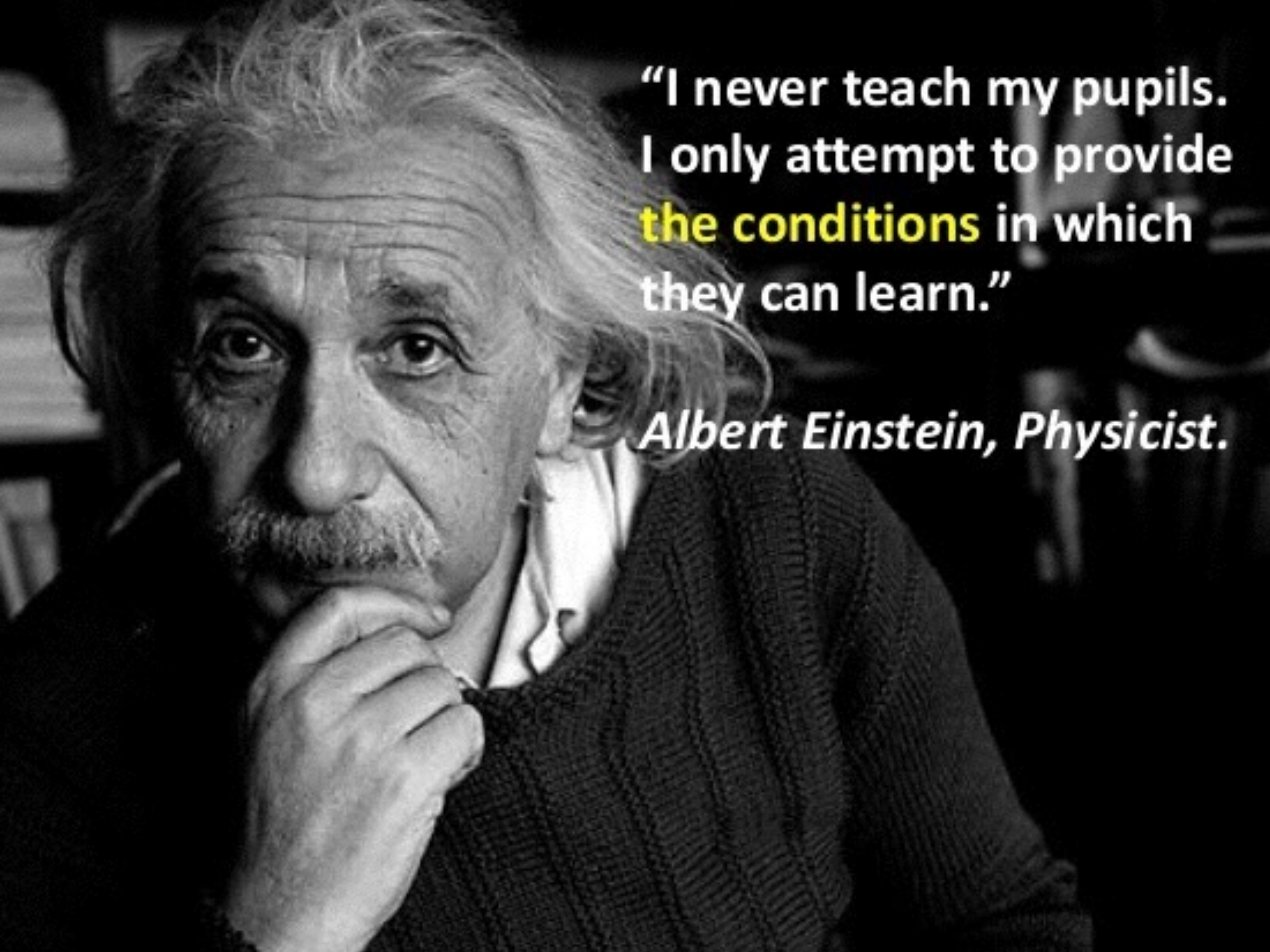
Group average: 84.6%

Combined average: 70.8%



TWO-STAGE EXAMS

- Students overwhelmingly **like** two-stage exams
 - They understand the learning benefits of **immediate feedback**, even if they find it somewhat frustrating to realize their mistakes right away
 - From a grade viewpoint, they cannot lose!
- Two-stage exams are **easy to implement**
 - Adds a bit more grading, but group copies are generally faster to grade
- Two-stage exams provide a much better **learning opportunity** for students than traditional exams

A black and white portrait of Albert Einstein. He is shown from the chest up, looking directly at the camera with a thoughtful expression. His hands are clasped together under his chin. He has his characteristic wild, white hair and a mustache. He is wearing a dark, textured sweater over a light-colored collared shirt. The background is dark and out of focus, suggesting a library or study with bookshelves.

“I never teach my pupils.
I only attempt to provide
the conditions in which
they can learn.”

Albert Einstein, Physicist.