FACILITATIVE TEACHING:
Helping Students “Get It” Themselves

SEPTEMBER 25, 2019
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“FACILITATIVE TEACHING”

• Working with groups of students
• Helping students figure things out

What’s difficult about this?
Why does it matter?
1. Why Facilitative Teaching Matters: Learning, Equity, and Mindset
2. Coaching the Problem Solving Process: Key to Successful Facilitative Teaching

**LEARNING OUTCOMES:**

...motivate your use of facilitative teaching

...develop strategies for guiding groups of students based on your own problem solving processes

...prepare to launch and facilitate group work using tested logistics and methods

**WHY FACILITATIVE TEACHING MATTERS**
Active learning increases student performance in science, engineering, and mathematics
Freeman et al. PNAS 2014, 111: 8410-8415.

Students 1.5 times more likely to fail in lecture-only courses.

Students perform 0.47 standard deviations better with active learning.

A  Failure rates
    Lecture
    Active Learning

B  Concept test results
    Lecture
    Active Learning

Carl E. Wieman PNAS 2014;111:8319-8320
Moderate active learning (15-40% of in-class time), along with weekly assignments & feedback:

“...increased course performance for all student populations, but worked disproportionately well for black students—halving the black–white achievement gap—and first-generation students—closing the achievement gap with continuing-generation students.”

*Getting Under the Hood: How and for Whom Does Increasing Course Structure Work?*
Sarah L. Eddy and Kelly A. Hogan
13 Oct 2017 [https://doi.org/10.1187/cbe.14-03-0050](https://doi.org/10.1187/cbe.14-03-0050)

“Women [may be] underrepresented in fields whose practitioners believe that raw, innate talent is the main requirement for success, because women are stereotyped as not possessing such talent.”

Expectations of brilliance underlie gender distributions across academic disciplines

Sarah-Jane Leslie, Andrei Cimpian, Meredith Meyer-Edward Freeland
DOI: 10.1126/science.1261375
Fixed Mindset
Leads to a desire to look smart, so tends to:
- Avoid challenges
- Give up easily
- See effort as fruitless or worse
- Ignore useful negative feedback
- Feel threatened by the success of others

Growth Mindset
Leads to a desire to learn, so tends to:
- Embrace challenges
- Persist in the face of setbacks
- See effort as the path to mastery
- Learn from criticism
- Find lessons and inspiration in the success of others

As a result, they may plateau early and achieve less than their full potential.

As a result, they reach even-higher levels of achievement.
COACHING THE PROBLEM SOLVING PROCESS

KEY TO SUCCESSFUL FACILITATIVE TEACHING

EXPERTISE IN PROBLEM SOLVING - PROOFS

• Recognizes multiple roles of proofs:
  - establishing veracity
  - providing explanation
  - organizing knowledge
  - uncovering fallacious, circular, or incomplete reasoning
  - discovering new results
  - communicating and debate ideas
  - developing intuition

• Uses multiple strategies to analyze, plan, and execute proofs
• Masters notation and logic simultaneously
• Pays attention to the genre of the written proof
  - Convention, style, clarity

- Weber, Students’ difficulties with proof, MAA

Examples or counter-examples from your experience, as a student or as a TA?
“Many problems with cognitive load are eased with categorisation (i.e. chunking).”

- Oliver Caviglioli / @olicav

PROBLEM SOLVING PROCESS = A FORM OF EXPERT KNOWLEDGE ORGANIZATION

• Often implicit: “expert amnesia”
• E.g.

  Feynman Method:
  1. Write down the problem.
  2. Think hard.
  3. Write down the solution.
PROBLEM/PROOF SOLVING PROCESS:

What steps/strategies do you use when solving a new problem/proof?

___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________

PROBLEM/PROOF SOLVING PROCESS:

Collective list:

___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________
___________________________ ___________________________
GUIDING QUESTIONS FOR INDIVIDUALS/SMALL GROUPS

(Think)
- Go back to your expert problem/proof process
- Individually, generate 5 questions based on problem-solving steps that you could ask an individual or small group to help them get unstuck

(Pair)
- Try out your questions with one other person. Get their feedback – how would they respond? Do they have suggestions for rephrasing?

(Share)
LOGISTICS FOR SUCCESS

WORKING WITH SMALL GROUPS OF STUDENTS

Groups and roles: logistics

• Teams of 3 or 4 students work best: small enough for everyone to participate, big enough for diverse perspectives.

• Random/self-selected groups at first is fine. Plan to change groups regularly. Then mix it up for different backgrounds, styles, personalities. Allows for intervention with dysfunctional groups, as well as benefits of diverse perspectives.

• Students should change roles regularly: e.g., scribe (at board), spokesperson, process monitor (decides when stuck, asks for help). Everyone has the “problem solver” role—all are thinking and contributing.

https://pogil.org/resources/implementation/instructors-guide
WORKING WITH SMALL GROUPS OF STUDENTS

Bring students (back) together as needed
• At the beginning
• Address common challenges/mistakes
• To move on to next problems/tasks/topics

https://pogil.org/resources/implementation/instructors-guide

OPEN-ENDED VS CLOSED QUESTIONS

Why, How, What (does this mean, are you thinking about, etc.)
→ Multiple ways to answer.
→ Answers are generally more than “yes/no.”

Is (this correct, etc.), do/does (you understand/this work),
What (is the definition of …, etc.)
→ Usually one correct answer, or may be answered “yes/no.”
“Do you have any questions?”

“What would you like me to clarify about _____ topic?”

**WORKING WITH SMALL GROUPS OF STUDENTS**

*Facilitating and prompting*

- Getting unstuck
  - Actively monitor groups and strive for some productive struggle, but not excessive.
WORKING WITH SMALL GROUPS OF STUDENTS

Facilitating and prompting

- Getting unstuck
  - Actively monitor groups and strive for some productive struggle, but not excessive.
  - Ask open-ended questions
  - Ask/address specific students by name
  - Inquire about steps in problem-solving process
  - Have them carry out some step(s) with you there
  - Let them continue without you
WORKING WITH SMALL GROUPS OF STUDENTS

• Troubleshooting
  - Check in and follow up if something seems off with a group
  - Make a change as needed: shuffle groups; change roles. If you’ve stated that these will change regularly in advance, it is not a big deal or anyone’s fault

SCENARIO 1:

In workshop, you approach a group that’s working on a proof. No one has written anything on the board. As soon as you approach, one of the group members tells you they’re stuck and have no idea how to do the proof.

What are your thoughts about this scenario?
What are your options for intervening?
What specifically could you say or do?
SCENARIO 2:

In workshop, you approach a group that’s working on a proof. One student is silently writing on the board; others are copying down their writing. No one is talking.

What are your thoughts about this scenario?
What are your options for intervening?
What specifically could you say or do?

SCENARIO 3:

Observing from a distance, you notice that one group of students has split—two are working productively together at the board, while one is sitting and working separately on paper.

What are your thoughts about this scenario?
What are your options for intervening?
What specifically could you say or do?