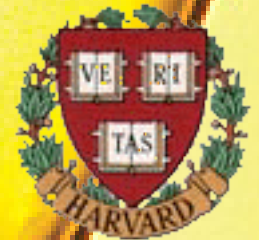


Educating the innovators of the 21st century



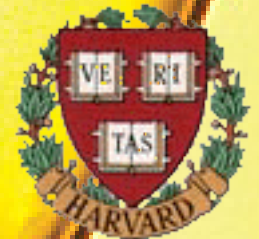
LASPAU/Brazil program
Harvard University
Cambridge, MA, 15 November 2012





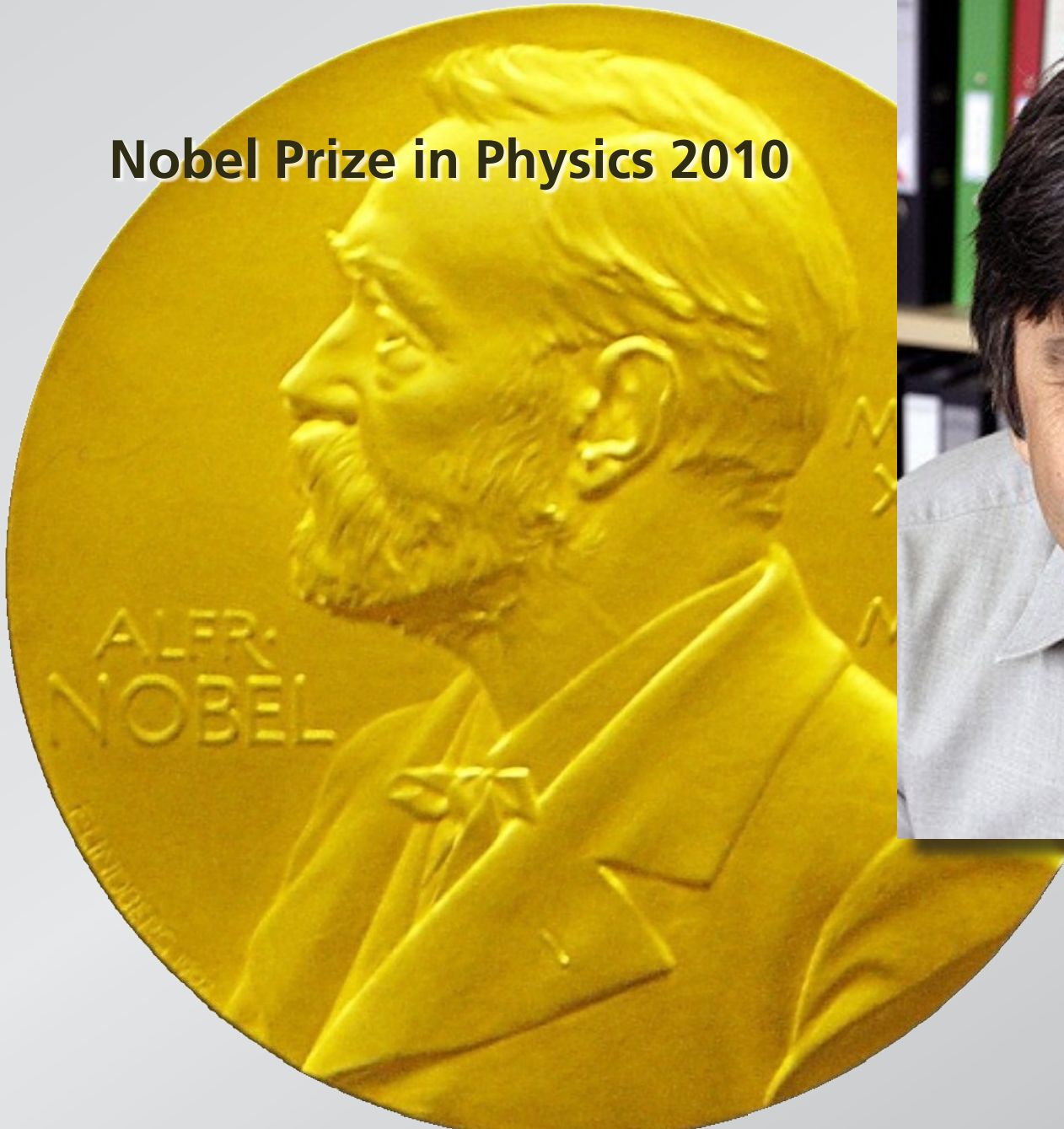
@eric_mazur

LASPAU/Brazil program
Harvard University
Cambridge, MA, 15 November 2012



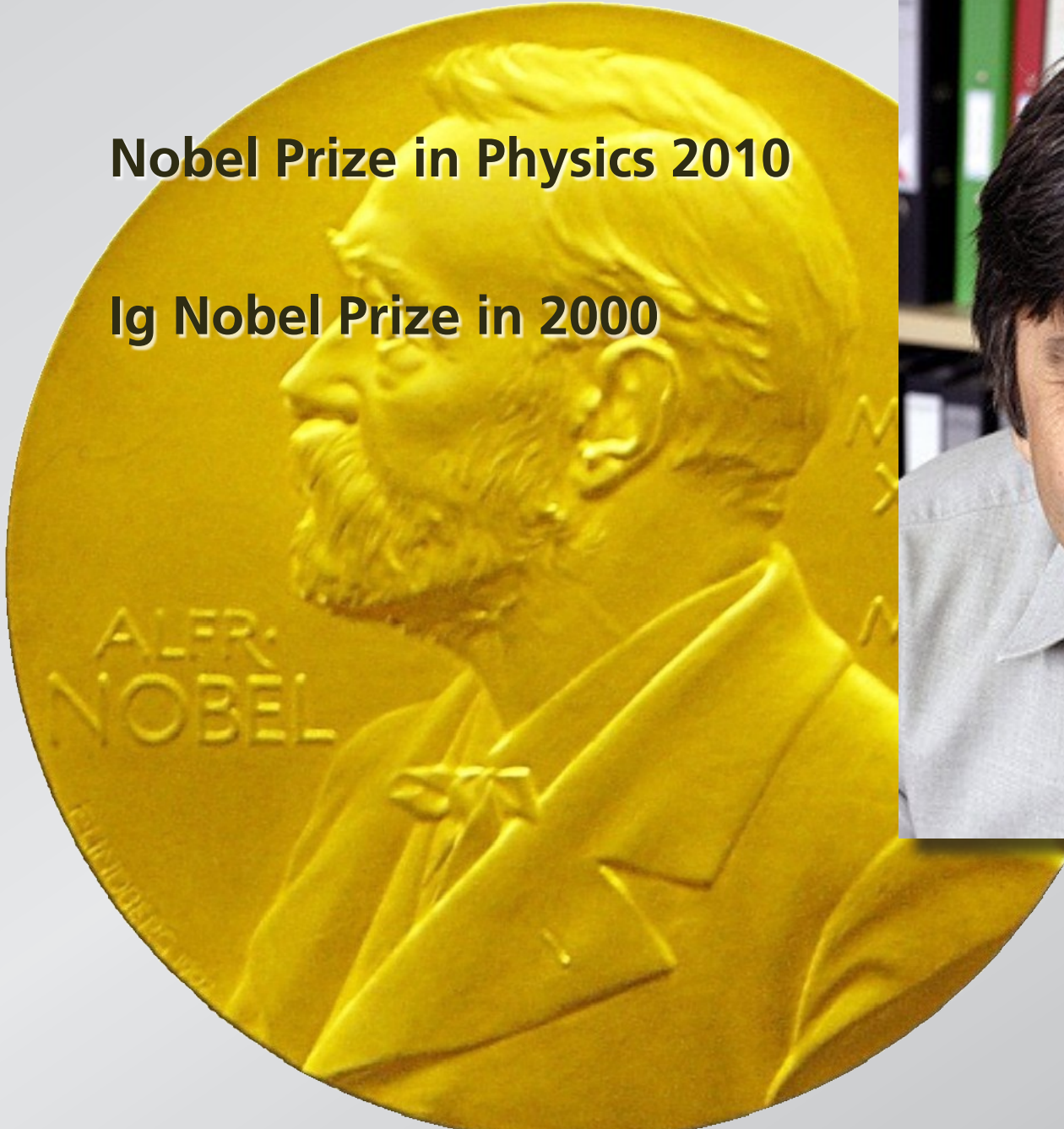
Innovation

Nobel Prize in Physics 2010

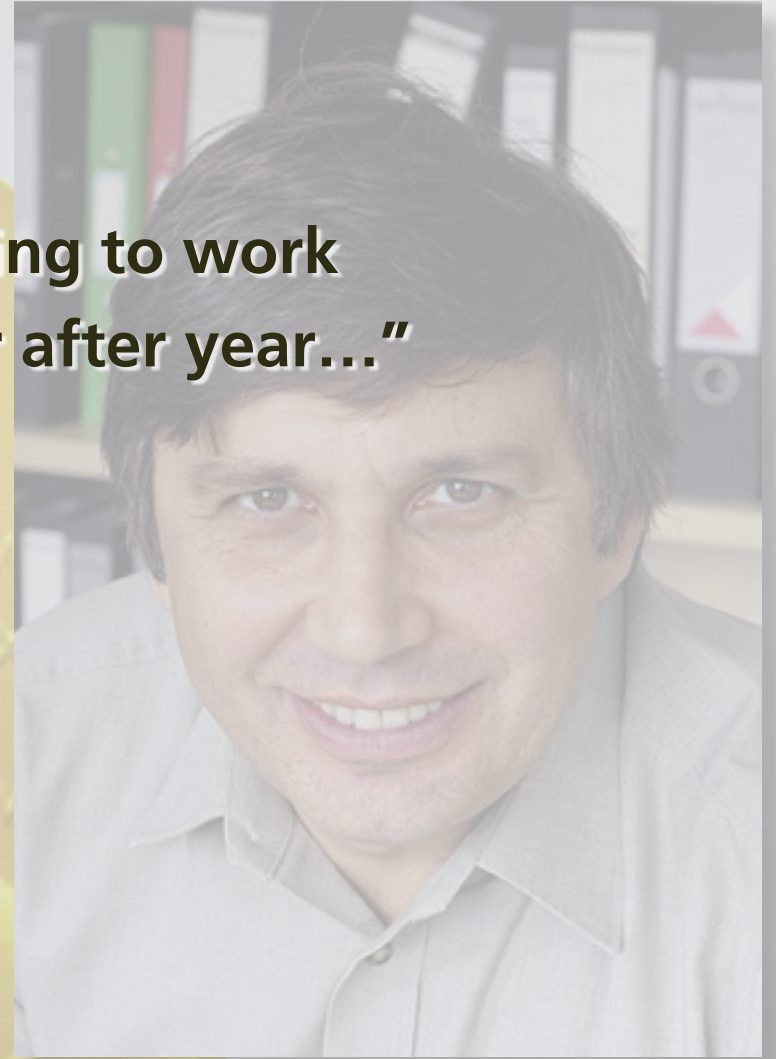


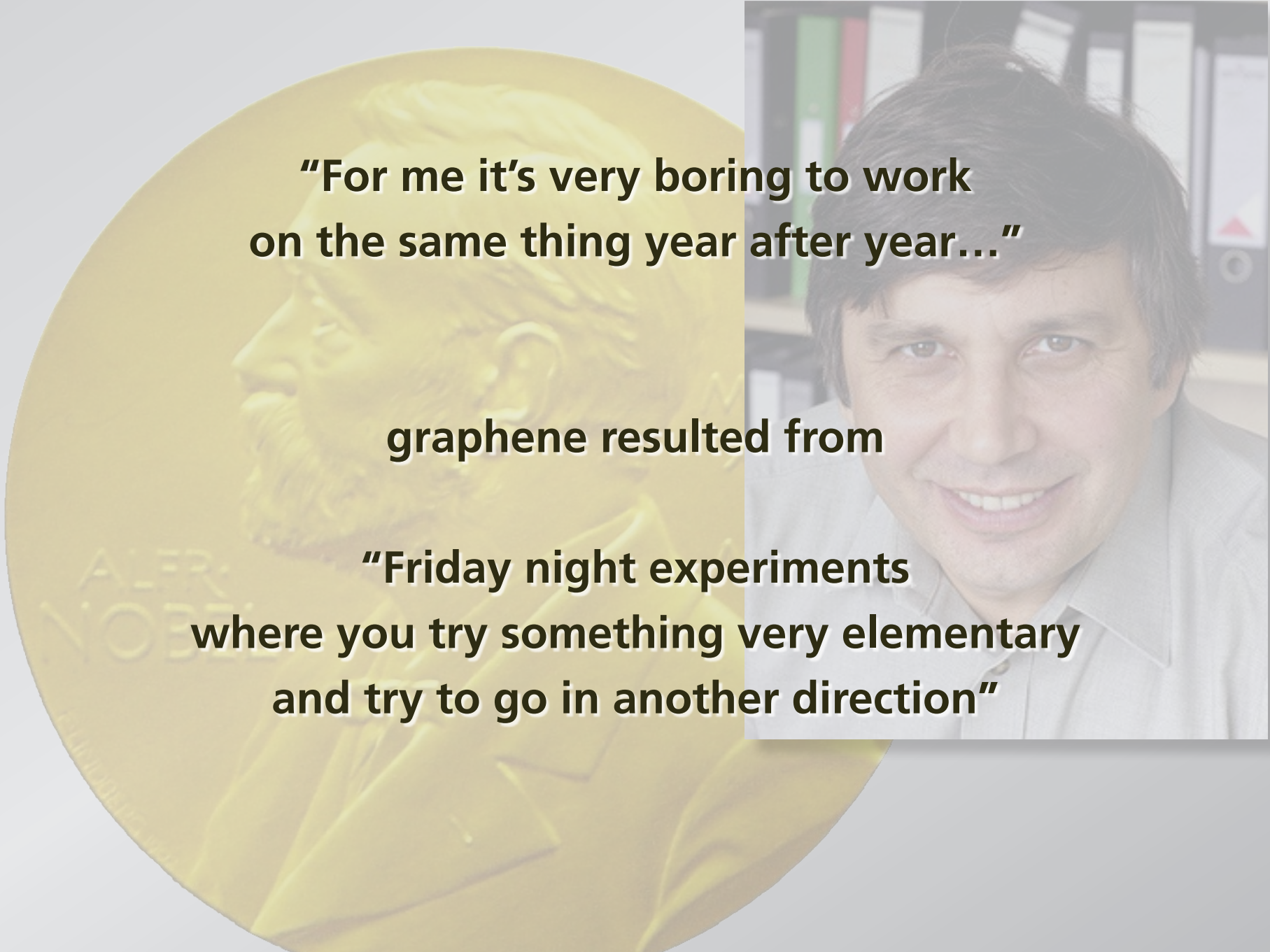
Nobel Prize in Physics 2010

Ig Nobel Prize in 2000



**“For me it’s very boring to work
on the same thing year after year...”**





**“For me it’s very boring to work
on the same thing year after year...”**

graphene resulted from

**“Friday night experiments
where you try something very elementary
and try to go in another direction”**

A glowing lightbulb with a warm yellow light emanating from it. The bulb is centered in the frame, and its glow fills the background. The text "how can we foster/teach innovation?" is superimposed on the lower half of the bulb.

how can we foster/teach innovation?



Need to...

- **teach *problem* solving**
- **encourage risk taking**





1 education

2 PI



1 education

2 PI

3 test




**better pay
attention!**

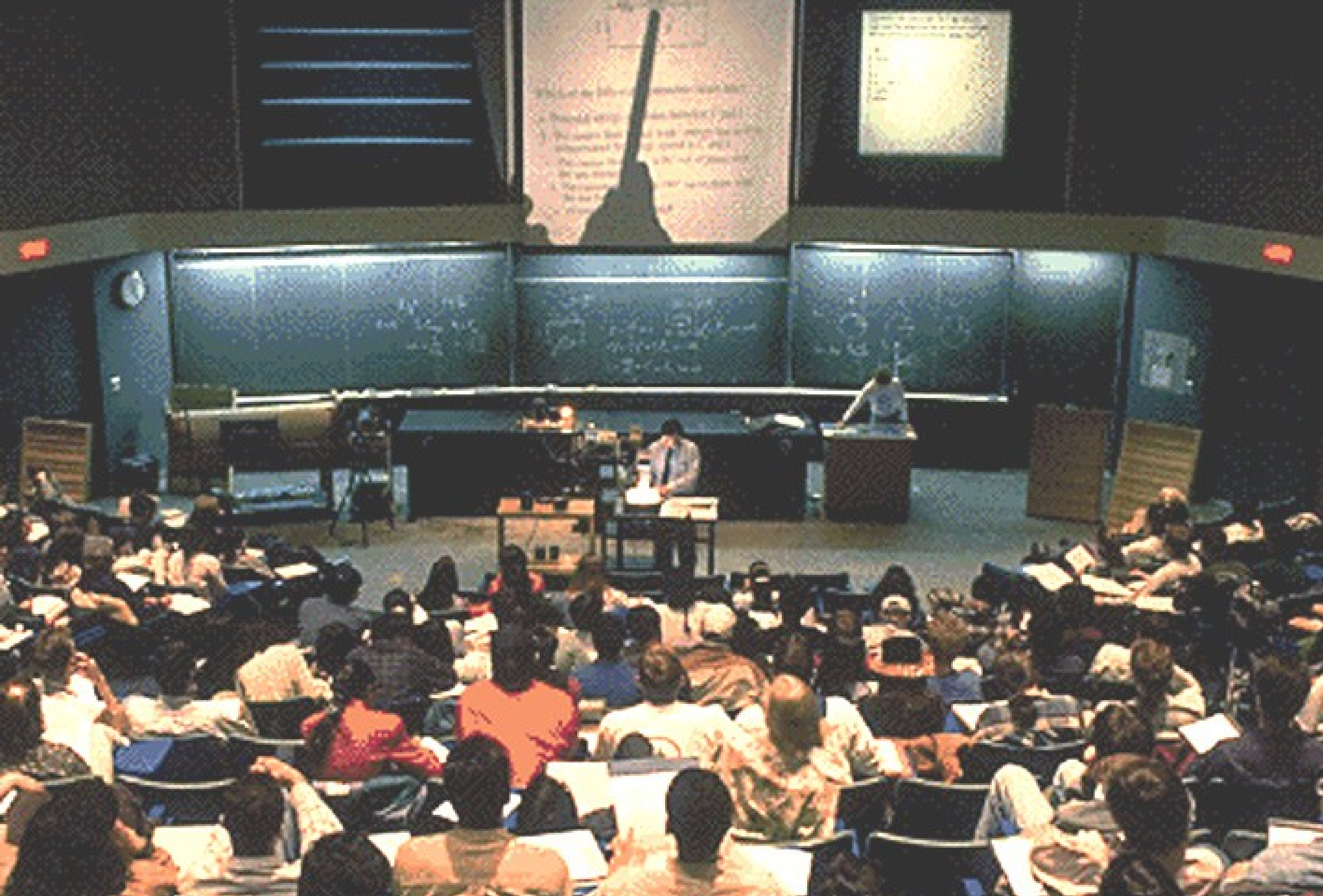
1 education

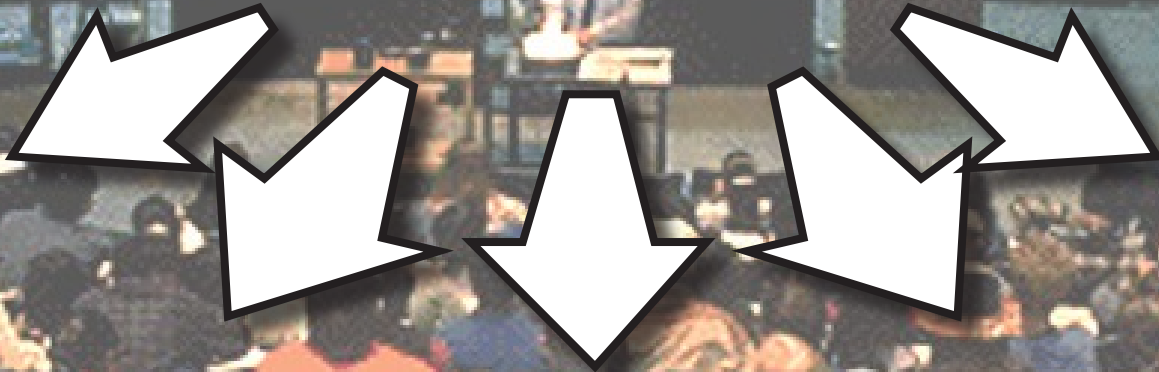
2 PI

3 test



**What happens
in a lecture?**





The result?

EDUCACION

Lack of learning

EDUCACION

Lack of learning

Lack of retention

assessment promotes memorization and stifles creativity

EDUCACION

problem

EDUCACION

problem

outcome

EDUCACION

problem

solution

outcome

EDUCACION

problem

solution

outcome

KNOWN

EDUCACION

problem

solution

outcome

UNKNOWN

KNOWN

EDUCACION

problem

solution

outcome

UNKNOWN

KNOWN

problem

EDUCACION

problem

solution

outcome

UNKNOWN

KNOWN

problem

procedure

EDUCACION

problem

solution

outcome

UNKNOWN

KNOWN

problem

procedure

answer

EDUCACION

problem

solution

outcome

UNKNOWN

KNOWN

problem

procedure

answer

KNOWN

problem

solution

outcome

UNKNOWN

KNOWN

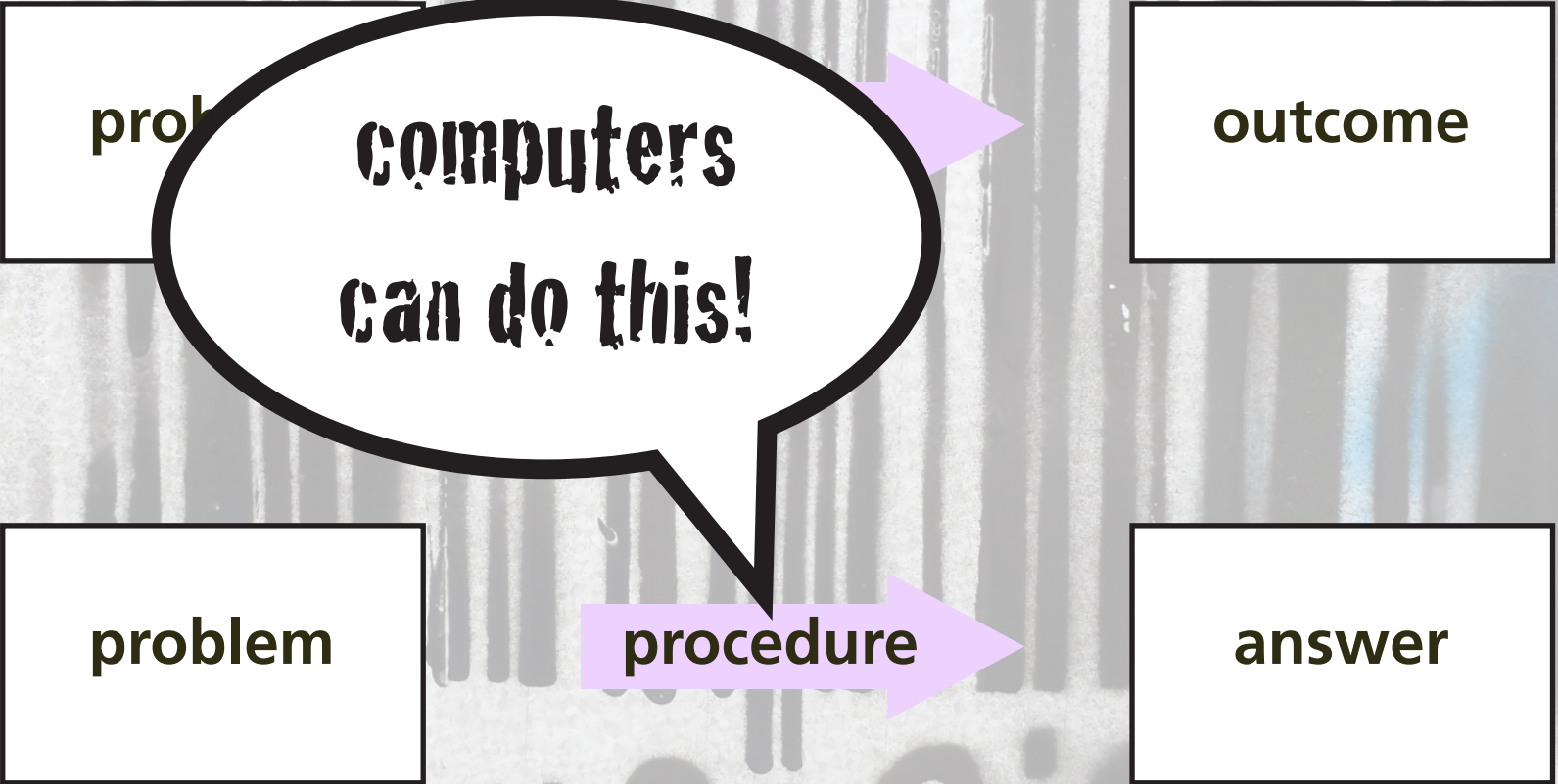
problem

procedure

answer

KNOWN

UNKNOWN



problem

solution

outcome

problem

pre... ver

REAL
problem solving

problem

approach 1

approach 3

approach 2

outcome

EDUCACION

problem

approach 1

approach 3

approach 2

outcome

assessment incompatible with real problem solving

EDUCACION

Traditional assesement

- focuses on outcome, not process

EDUCACION

Traditional assesement

- **focuses on outcome, not process**
- **discourages risk taking**

EDUCACION

Traditional assesement

- focuses on outcome, not process
- discourages risk taking
- focuses on individual, not group

EDUCACION

Traditional assesement

- focuses on outcome, not process
- discourages risk taking
- focuses on individual, not group
- does not mirror future work environment



1 education

2 PI



1. transfer of information



1. transfer of information

2. assimilation of that information




1. transfer of information (in class)

2. assimilation of that information



1. transfer of information (in class)

2. assimilation of that information (out of class)



**Should focus
on THIS!**

1. transfer of information (in class)

2. assimilation of that information (out of class)

- 
- 1. transfer of information (in class)**
 - 2. assimilation of that information (out of class)**



1. transfer of information (out of class)

2. assimilation of that information (in class)

Peer



1. transfer of information (out of class)

2. assimilation of that information (in class)

INSTRUCTION

question

1 education

2 PI

question



think

question



think



poll

question



think



poll



discuss

question



think



poll



discuss



repoll

question



think



poll



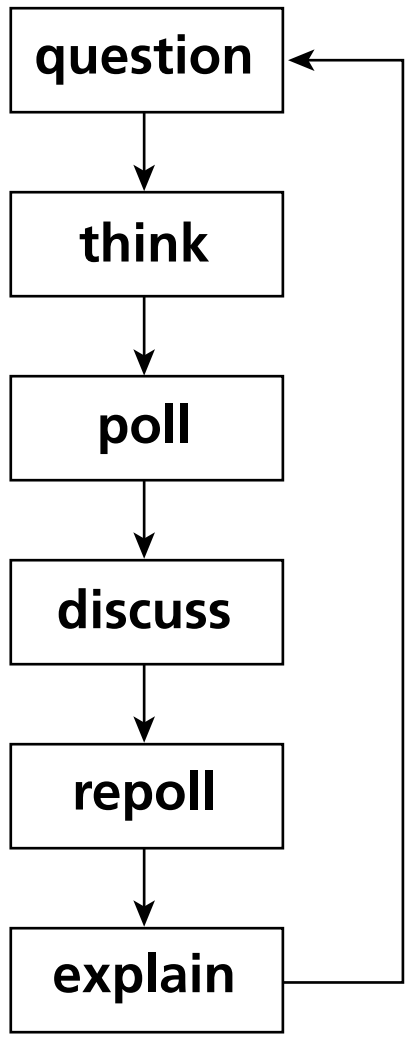
discuss

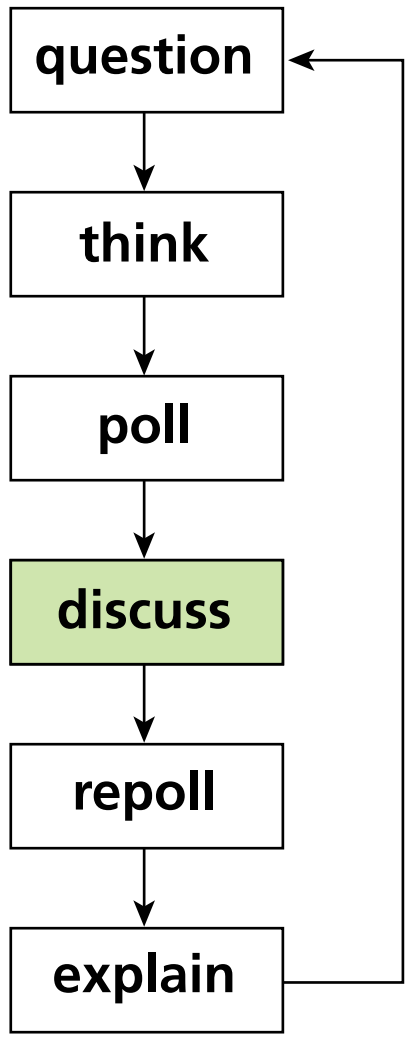


repoll



explain





1 lecture

2 PI

Peer
Higher learning & gains

INSTRUCTION

1 education

2 PI

3 test

Higher learning gains

Better retention

INSTRUCTION

1 education

2 PI

3 test



1 education

2 PI

3 test

in a lecture, students...

1 education

2 PI

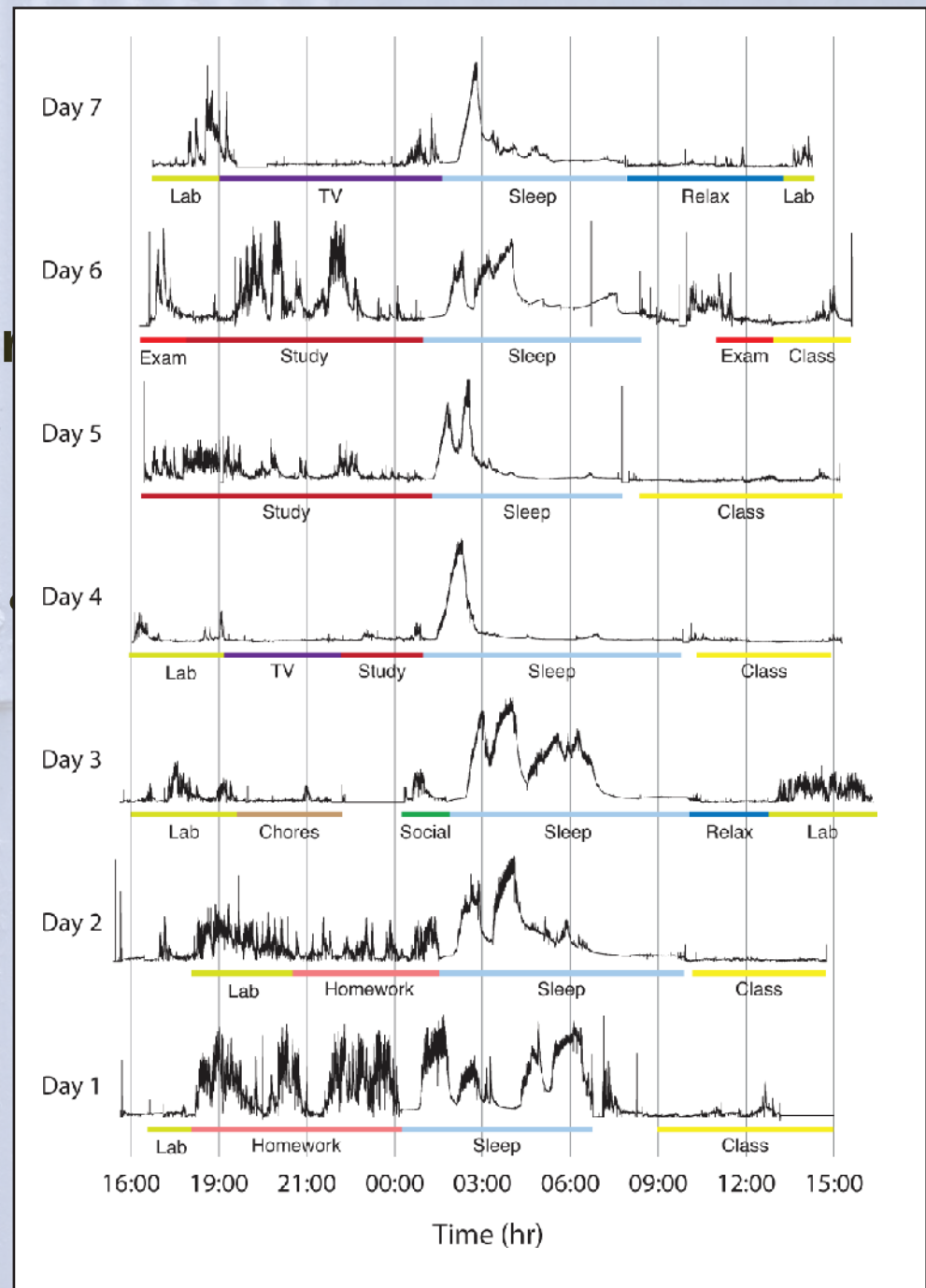
3 test

in a lecture, students...

1. don't pay utmost attention

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

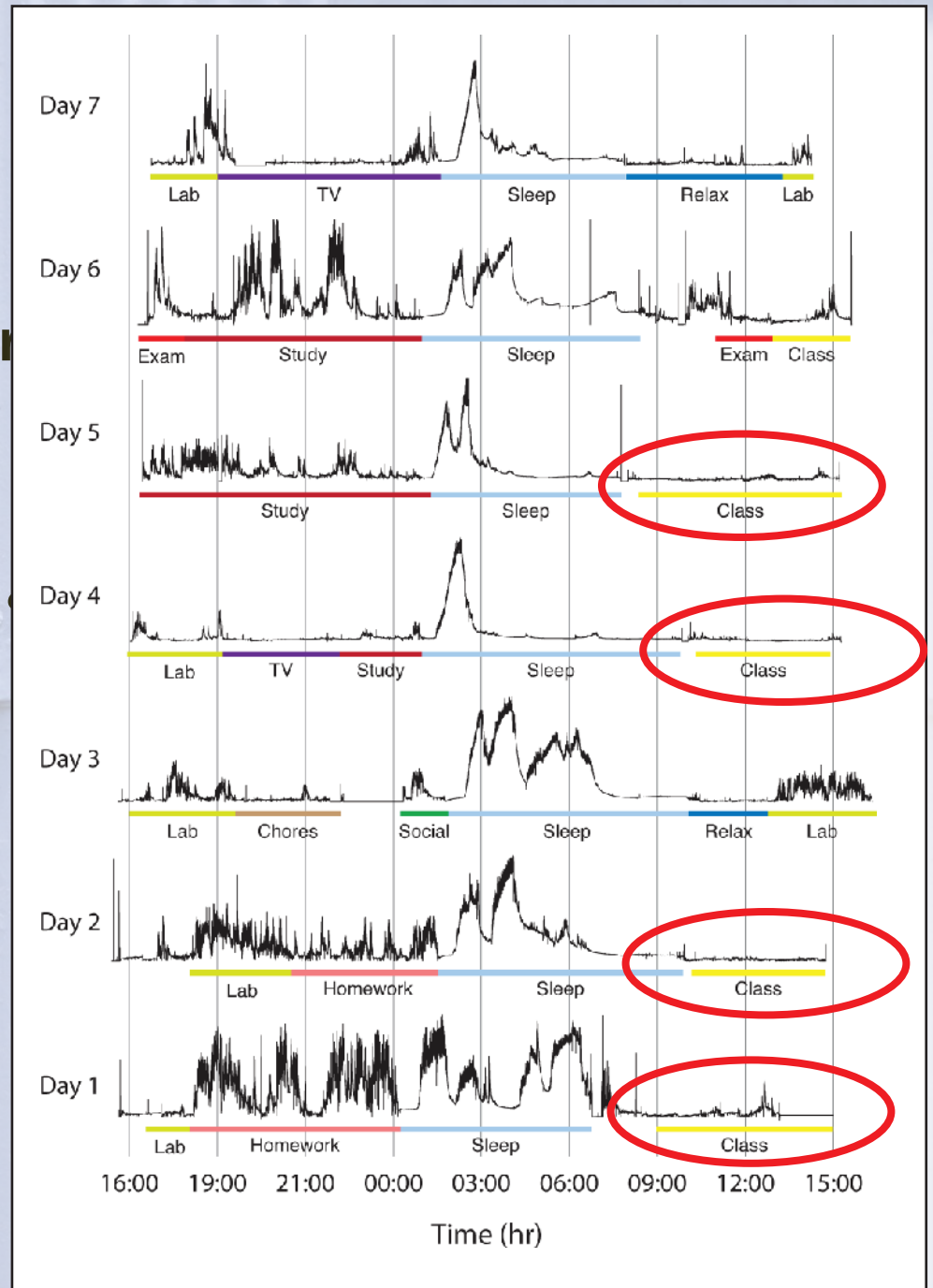
1 education

2 PI

3 test

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

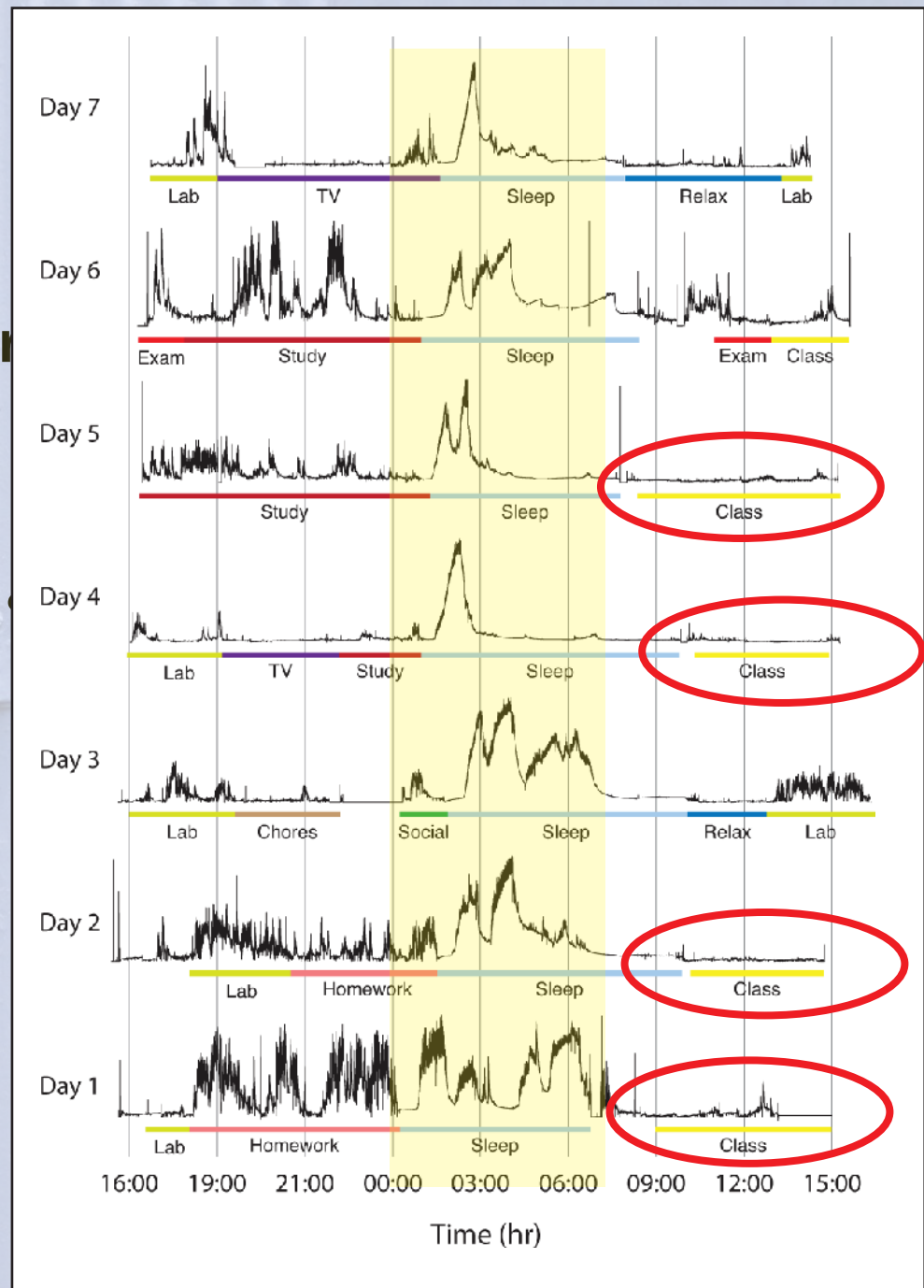
1 education

2 PI

3 test

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

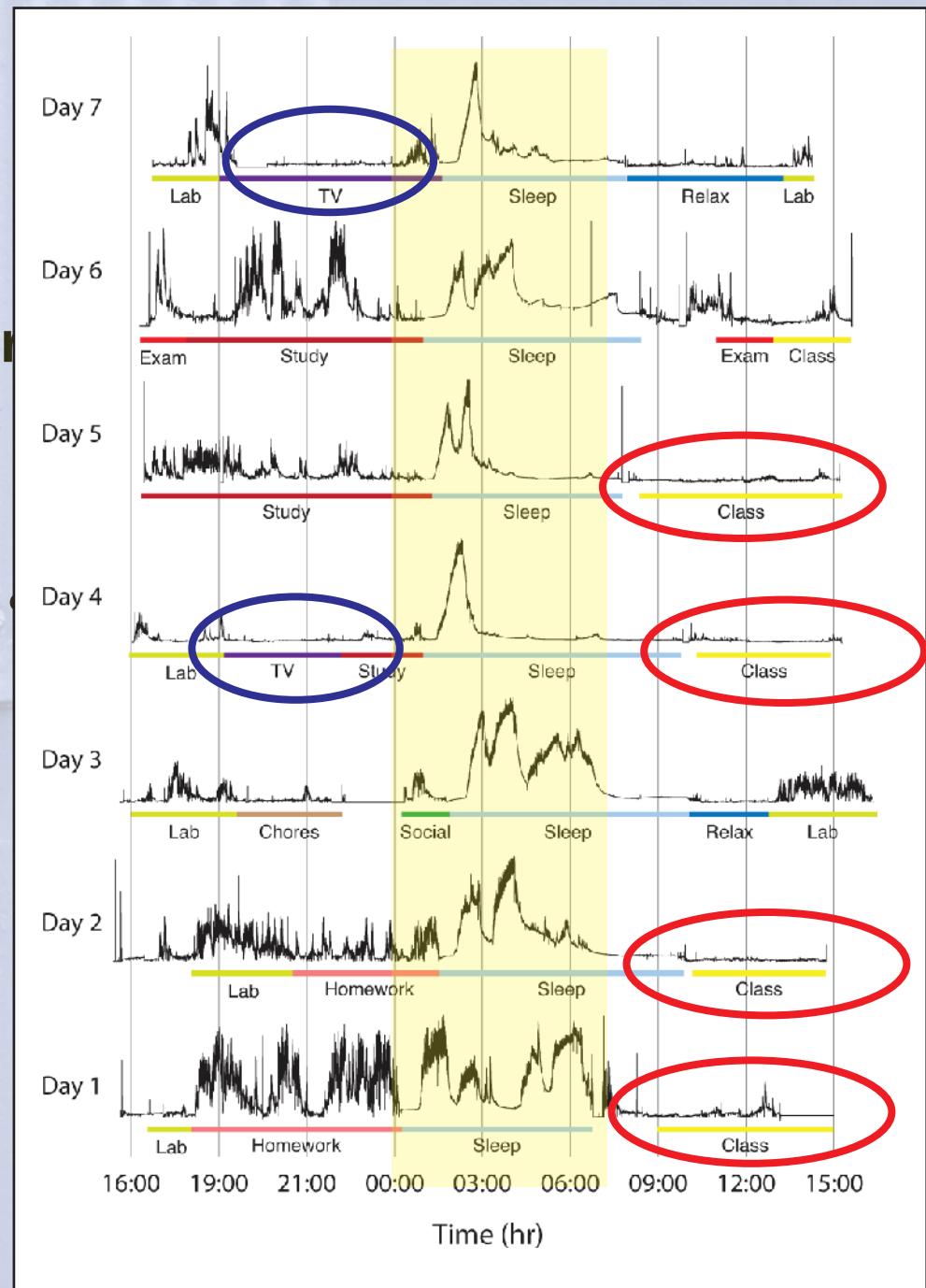
1 education

2 PI

3 test

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

1 education

2 PI

3 test

in a lecture, students...

- 1. don't pay utmost attention**
- 2. think they know it**

in a lecture, students...

- 1. don't pay utmost attention**
- 2. think they know it**
- 3. are not confronted with misconceptions**

in a lecture, students...

1. don't pay utmost attention

2. think they know it

3. are not confronted with misconceptions

false
sense of security



1 education

2 PI

3 test



an illusion. . .

1 education

2 PI

3 test



With a simple change, Peer Instruction...

- teaches *real* problem solving
- encourages risk taking

1 education

2 PI

3 test

Funding:

National Science Foundation

for a copy of this presentation:

mazor.harvard.edu

Follow me!



[eric_mazor](https://twitter.com/eric_mazor)

Google™

Google Search

I'm Feeling Lucky

Google™

mazur

Google Search

I'm Feeling Lucky

Google™

Google Search

I'm Feeling Lucky

Google™

mazur

Google Search

I'm Feeling Lucky

Funding:

National Science Foundation

for a copy of this presentation:

mazor.harvard.edu

Follow me!



[eric_mazor](https://twitter.com/eric_mazor)