Using technology to engage students

University of Iowa
Iowa City, IA, 30 April 2010

My point

Technology is not a magic bullet

Introduction

A brief history of Information Technology

- blackboard
- overhead projector
- television
- computer

Introduction

What's wrong with old methods for presenting content?

The Psalms Scroll of Qumran Cave 11

Book of Hours, Valencia, c. 1460

Belles Heures du Duc de Berry
1408-09
The Way to Calvary

subiecuntur. Similiter et facta bona manifesta sunt: et que aliter se habent abscondi non possunt. VII

Quicunq; sunt sub iugo serui dnos suos oim honore dignos arbitrentur: ne nome dni et doctrina blasphemet. Qui aut fideles habent dnos no contemnat quia fres sunt: sed magis seruiat quia fideles sunt et dilecti: qa beneficii participes sunt. Hec doce et exhortare. Si qs aliter docet et no acquiescit sanis sermonibus dni nri ihesu xpi: et ei que secm pietatem est doctrine: superbus nichil sciens sed languens circa questiones et pugnas verborum: ex quibus oritur inuidie contentiones blasphemie suspiciones male-dictiones hominum mentes corruptorum et q veritate priuatorum existimantium questum esse pietatem. Est aut questus magnus: pietas cum sufficientia. Nichil enim intulimus in hunc mundum: haut dubium qa nec auferre qd possumus. Habentes aut alimenta et quibus tegamur: his contenti simus. Nam q volunt diuites fieri incidunt in temptationem et la-

diam unum: q solus habet immortalitatem et lucem inhabitat inaccessibilem: quem nullus hominum vidit sed nec videre potest: cui honor et imperium sempiternum amen.

Diuitibus huius seculi precipe no sublime sapere: neq; sperare in incerto diuitiarum sed in deo uiuo q prestat nobis oia abunde ad fruendum: bene agere: diuites fieri in bonis operibus: facile tribuere: communicare: thesaurizare sibi fundamentum bonum in futurum: ut apprehendat veram vitam. O thimothee depositum custodi: deuitans prophanas vocum nouitates et oppositiones falli nominis scientie: quam quidam promittentes circa fidem exciderunt. Gratia tecum amen.

Explicit epistola prima ad thimotheum.
Incipit argumentum in epistam secundam

ad thimotheum scribit de exhortatione martirii et omnis regule veritatis: et qd futurus sit temporibus nouissimis: et de sua passione: scribit a roma. Explicit argumentum. Incipit epistola secunda ad thimotheum

Paulus apostolus ihesu xpi ihesu misericordia p voluntatem


PROLO
Gen xxxi

DISCORSI
E
DIMOSTRAZIONI
MATEMATICHE,

intorno à due nuoue ſcienze

Attenenti alla

MECANICA & i MOVIMENTI LOCALI,

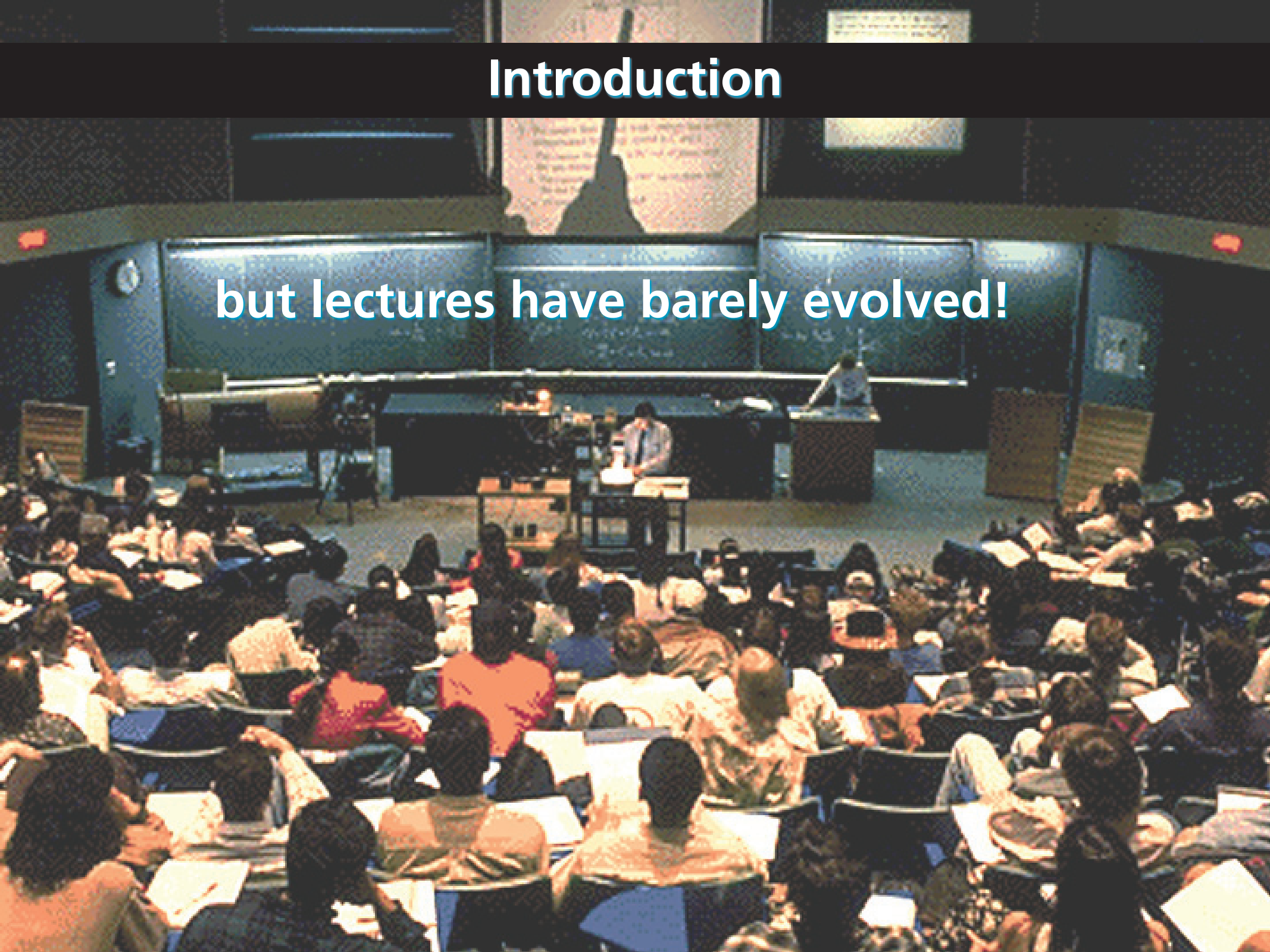
del Signor

GALILEO GALILEI LINCEO,
Filoſofo e Matematico primario del Sereniſſimo
Grand Duca di Toſcana.

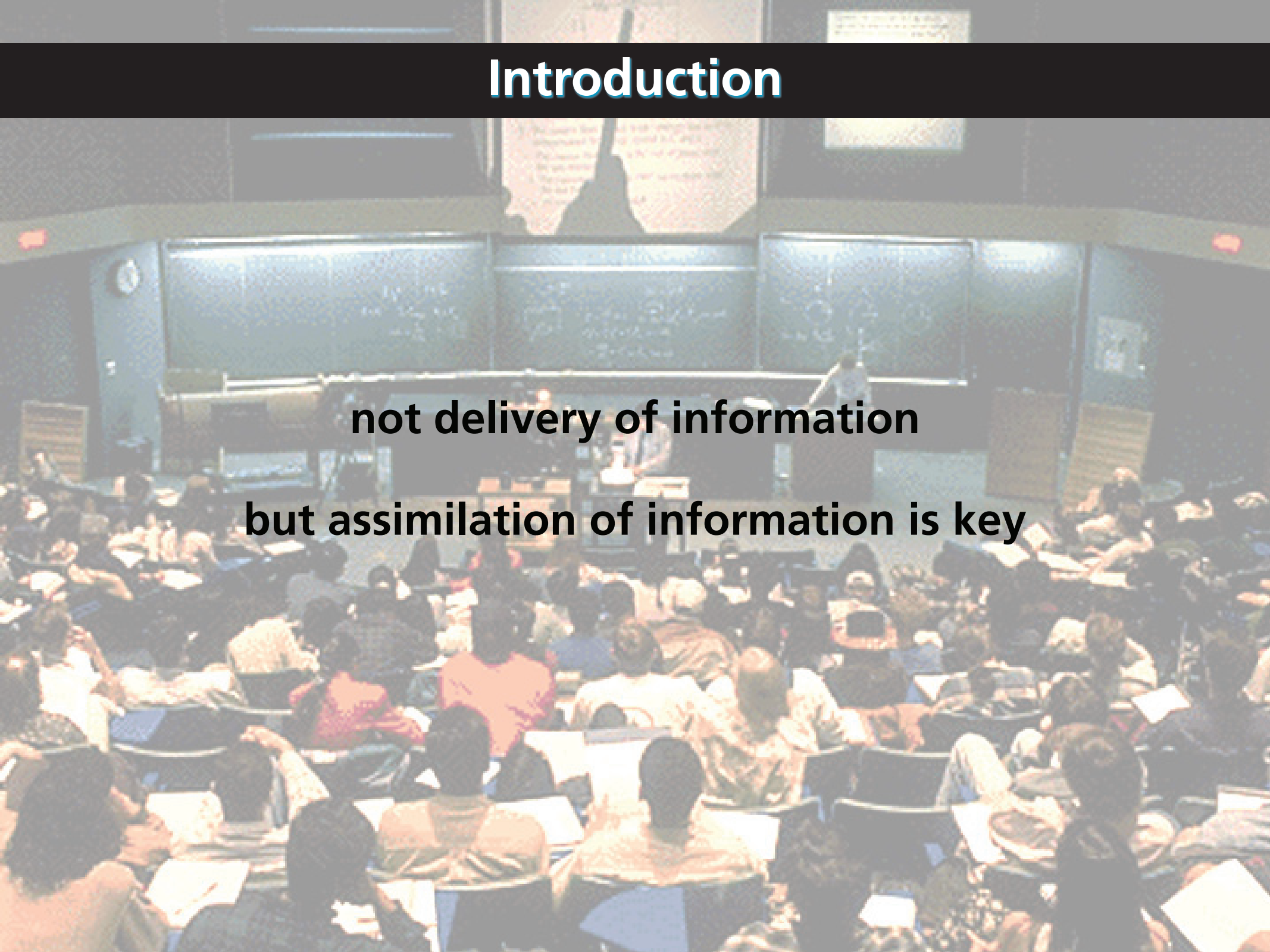
Con vna Appendice del centro di granità d'alcuni Solidi.

IN LEIDA,
Appreſſo gli Elſevirii. M. D. C. XXXVIII.

Introduction



Introduction



not delivery of information

but assimilation of information is key

Introduction

think about educational goals

before introducing technology

Introduction

What constitutes effective use of technology?

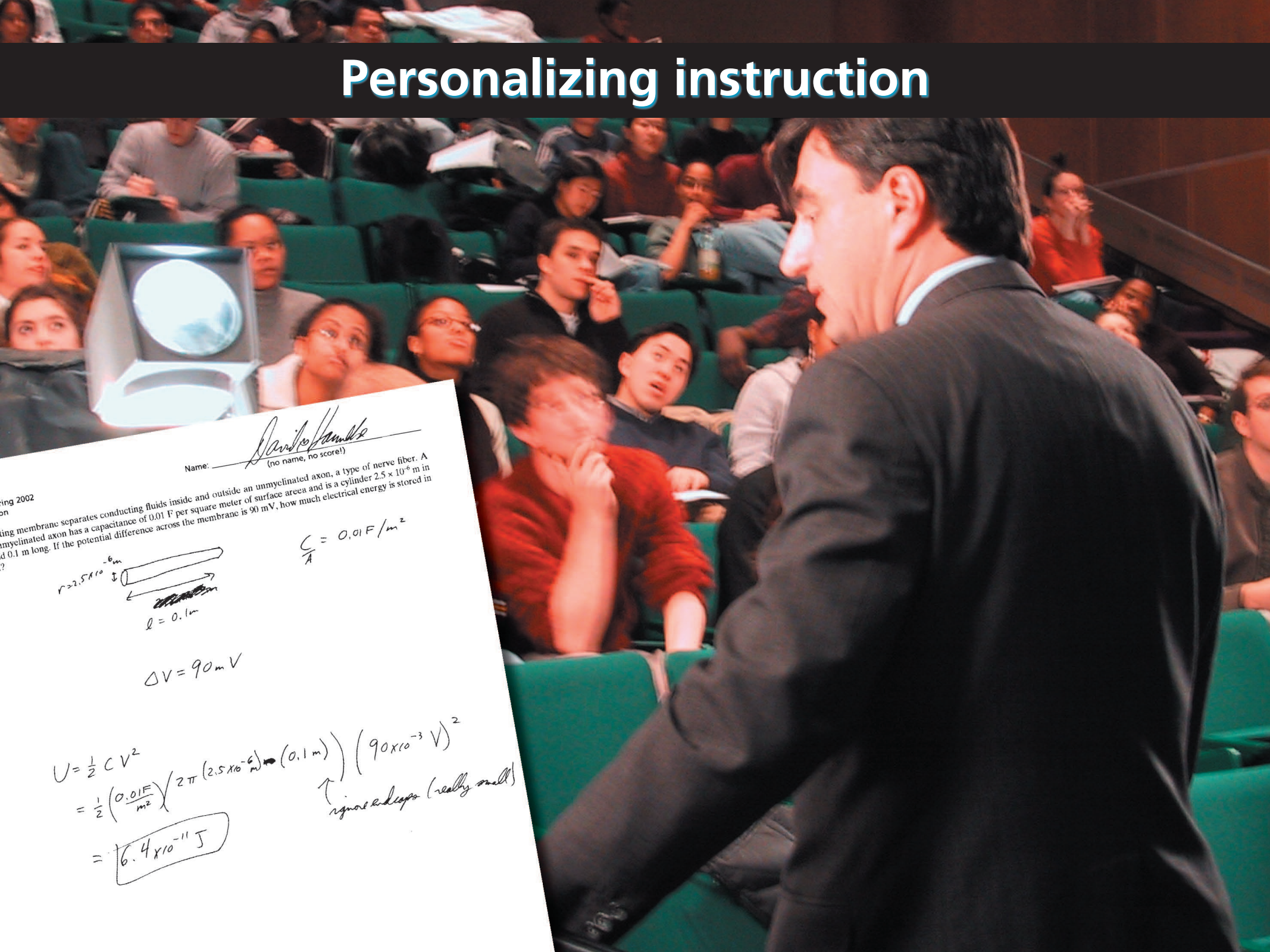
- furthers educational goals
- facilitates new modes of learning
- investment commensurate with returns
- reusable and flexible

Outline

Outline

- Personalizing instruction
- Promoting thinking
- Integrating instruction

Personalizing instruction



Name: David Hamilton (no name, no score!)

ring 2002
on

ting membrane separates conducting fluids inside and outside an unmyelinated axon, a type of nerve fiber. A
nmyelinated axon has a capacitance of 0.01 F per square meter of surface areea and is a cylinder 2.5×10^{-6} m in
d 0.1 m long. If the potential difference across the membrane is 90 mV, how much electrical energy is stored in
?

$\frac{C}{A} = 0.01\ F/m^2$

$r = 2.5 \times 10^{-6}$ m

$\ell = 0.1$ m

$\Delta V = 90$ mV

$U = \frac{1}{2} C V^2$

$= \frac{1}{2}\left(\frac{0.01\ F}{m^2}\right)\left(2\pi (2.5 \times 10^{-6}\ m)(0.1\ m)\right)(90 \times 10^{-3}\ V)^2$

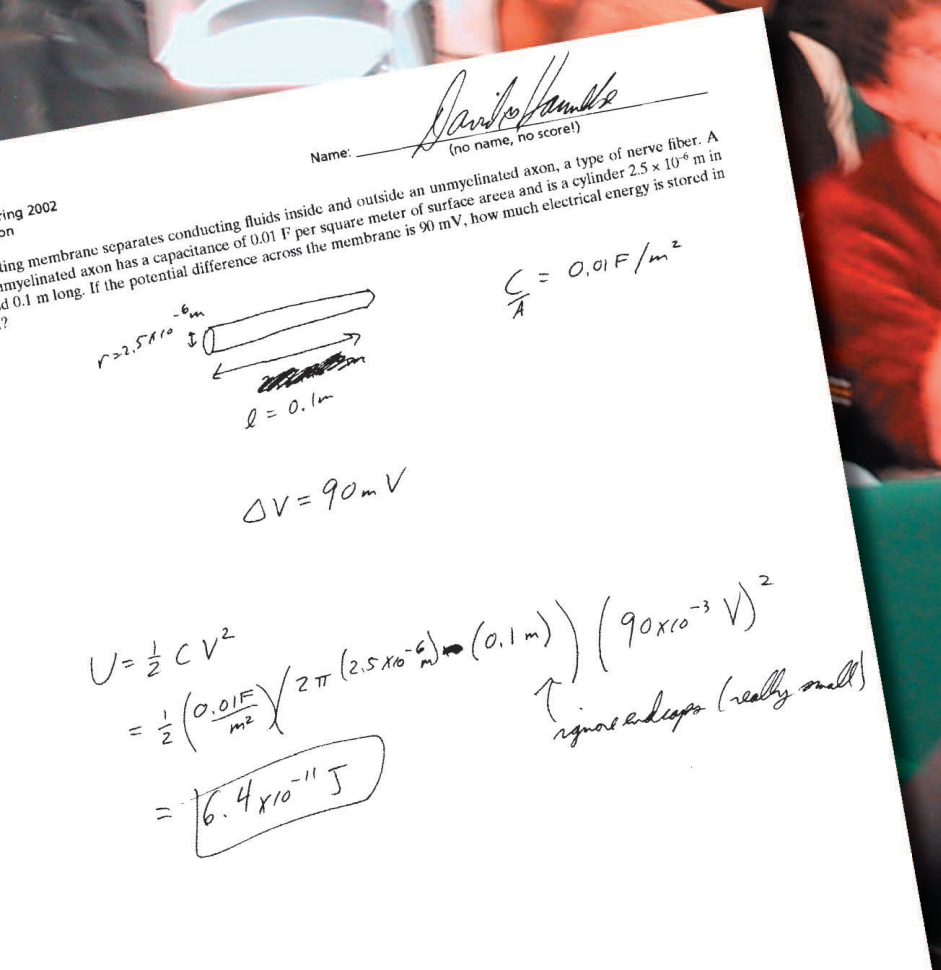
↑ ignore endcaps (really small)

$= 6.4 \times 10^{-11}\ J$

Personalizing instruction

nameless

faces



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Personalizing instruction

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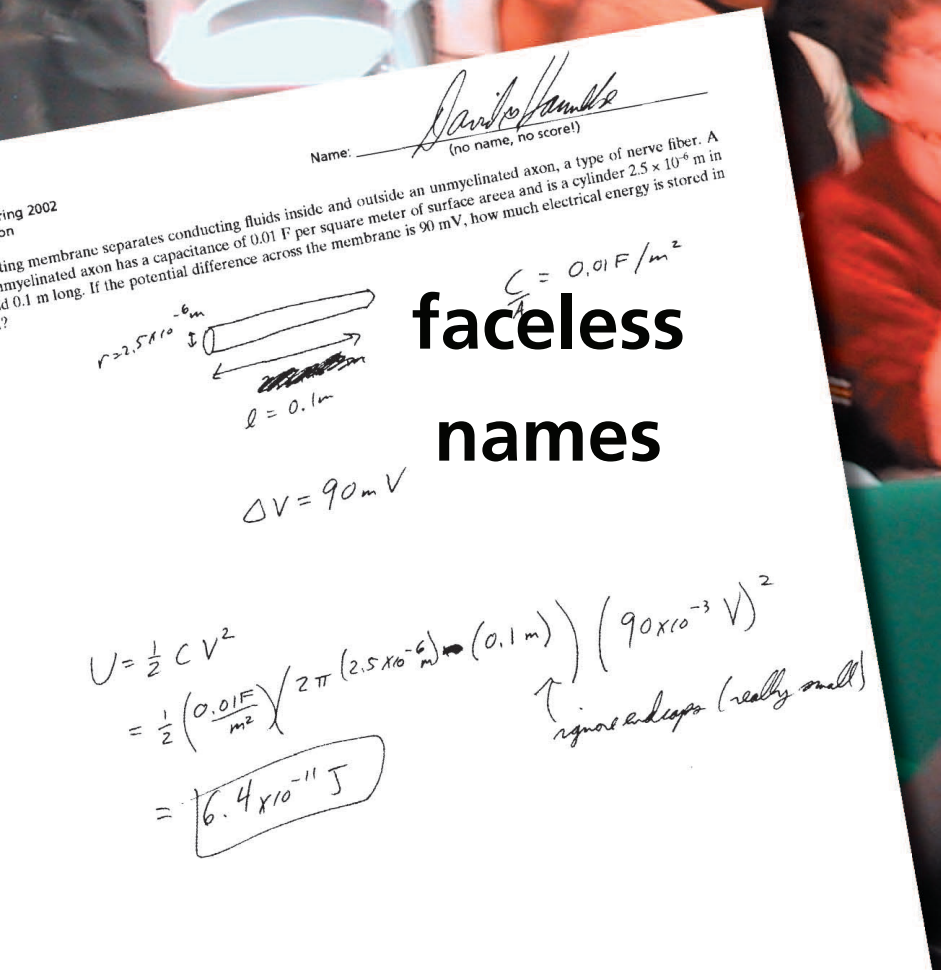
faces

faceless

names



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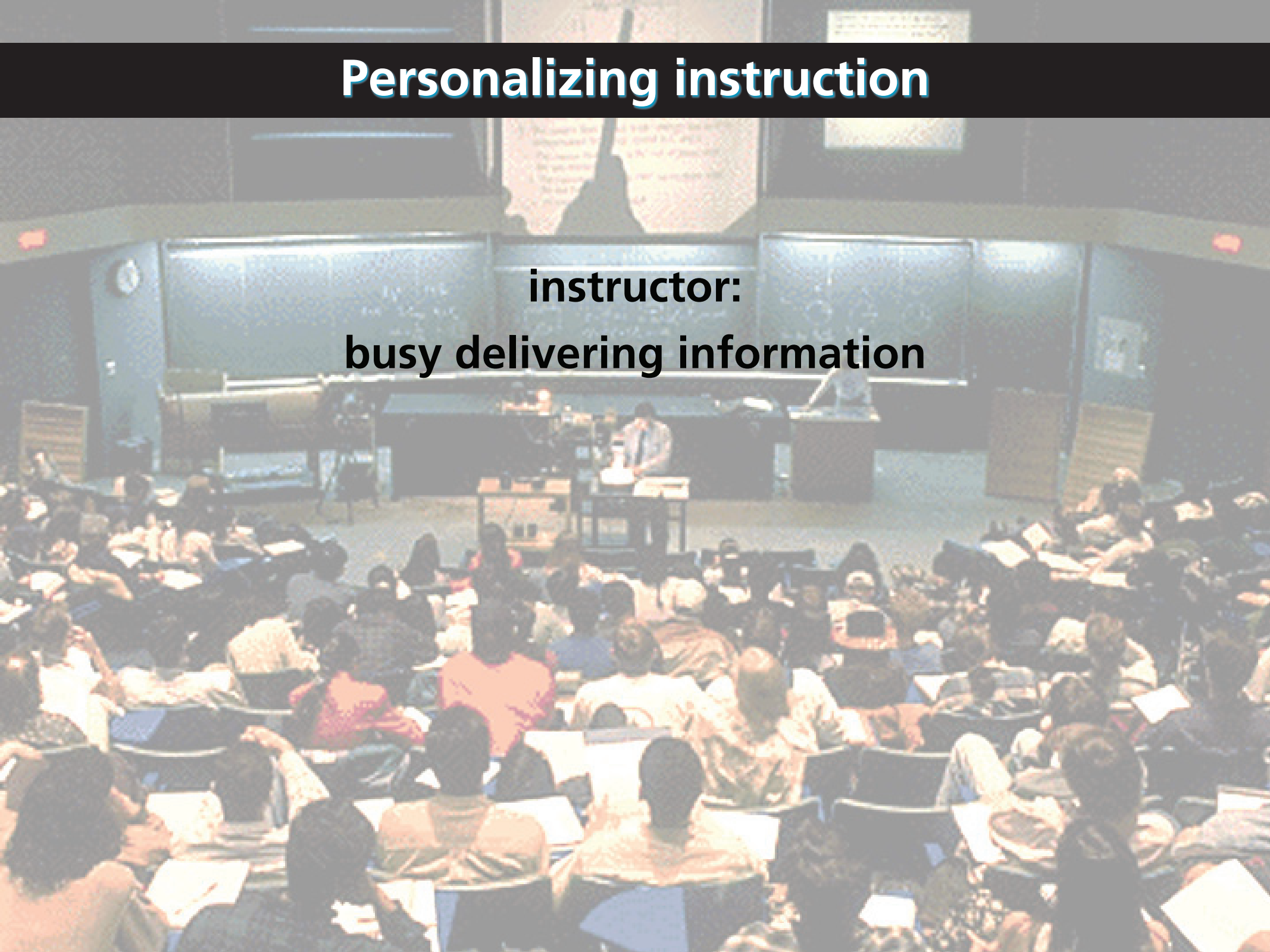
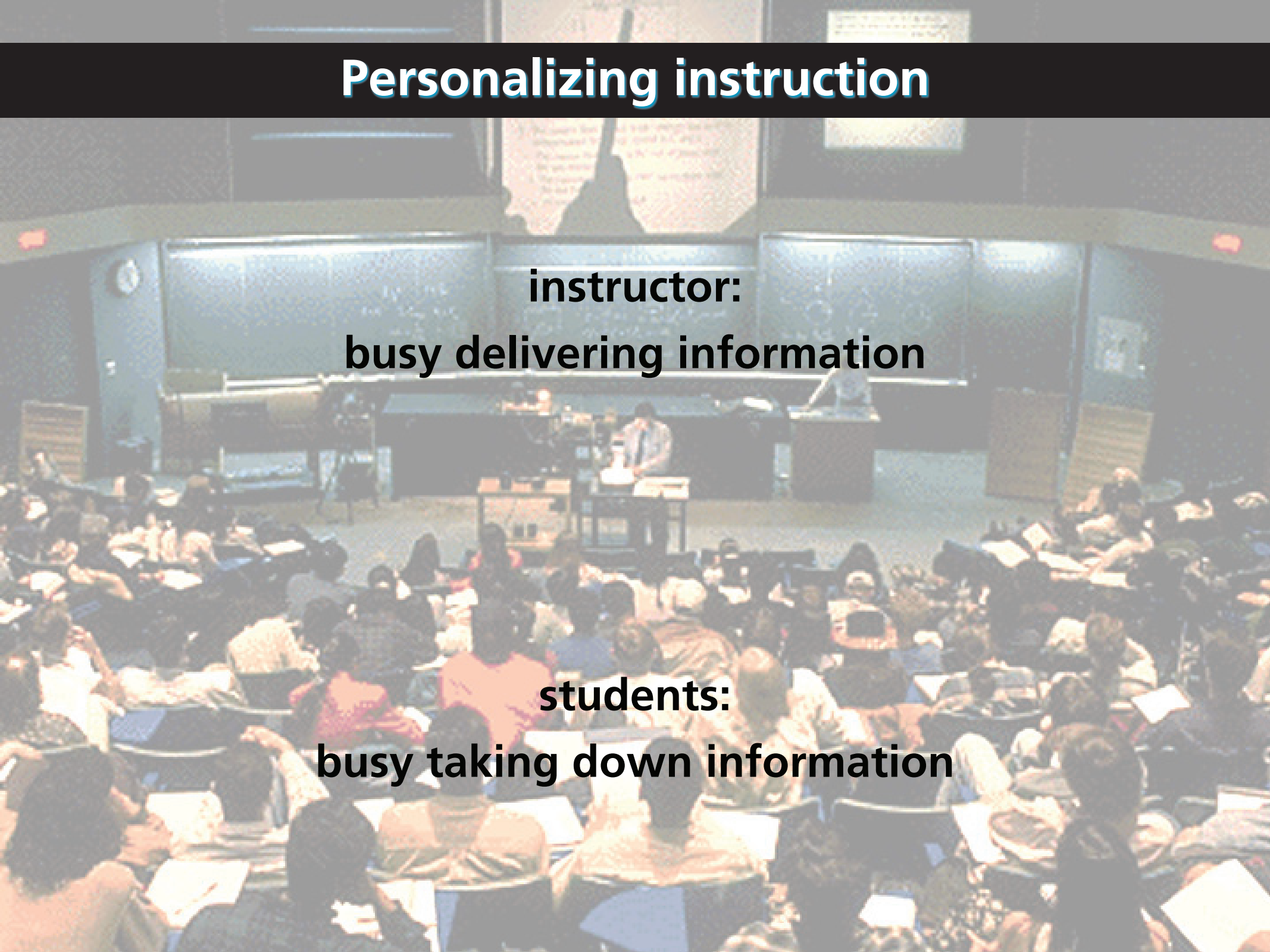
Personalizing instruction



instructor:

busy delivering information

Personalizing instruction



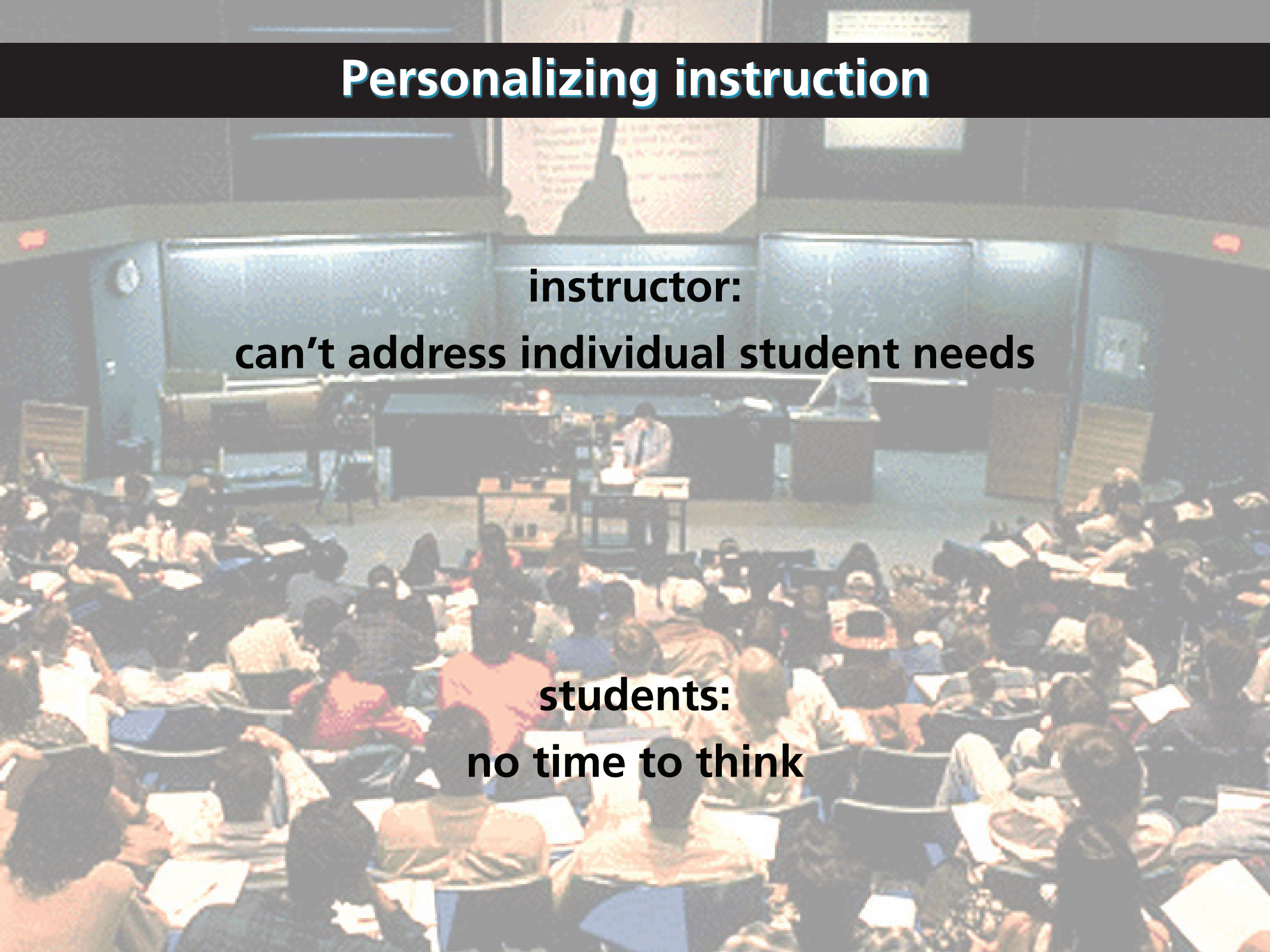
instructor:

busy delivering information

students:

busy taking down information

Personalizing instruction



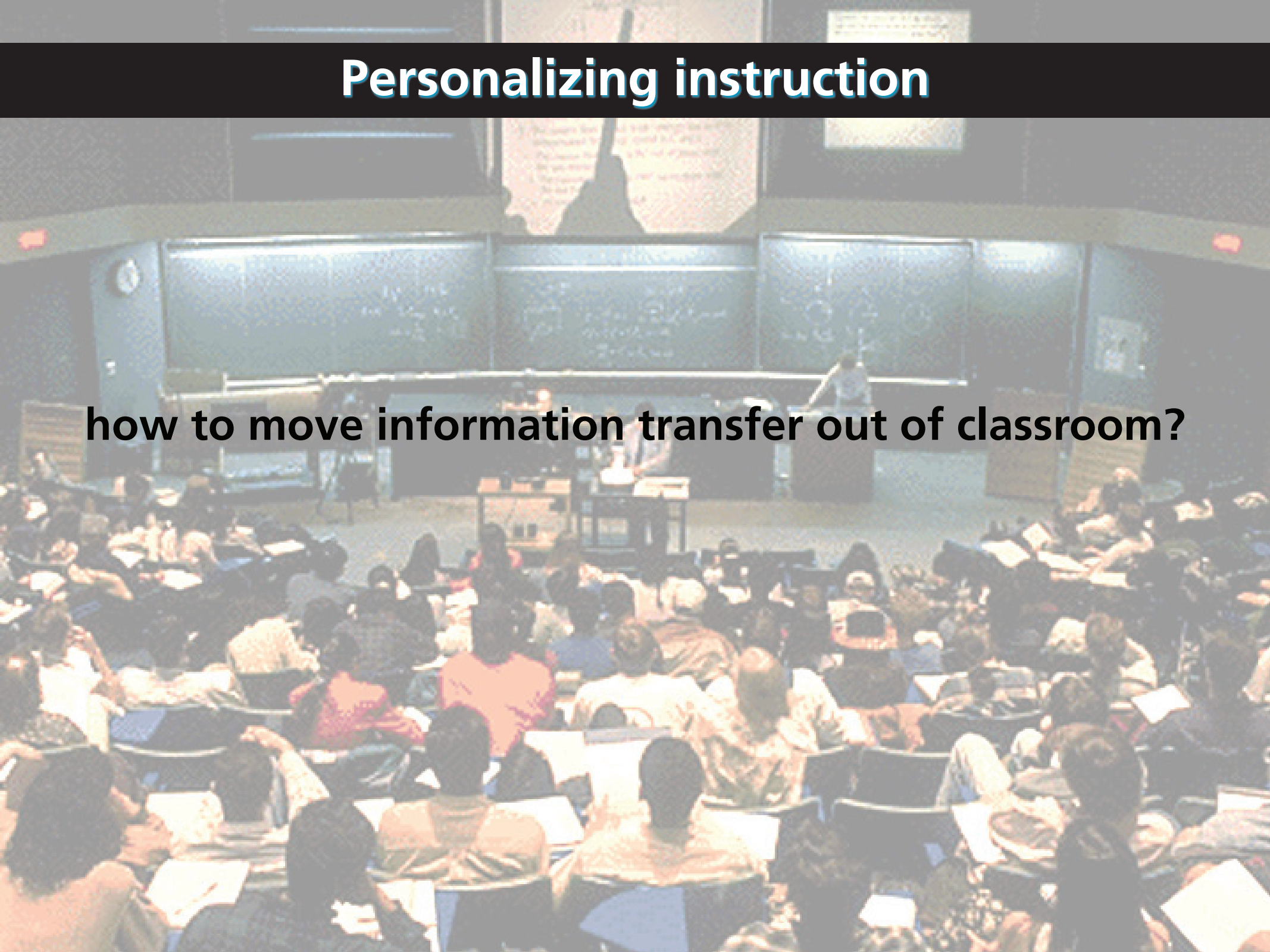
instructor:

can’t address individual student needs

students:

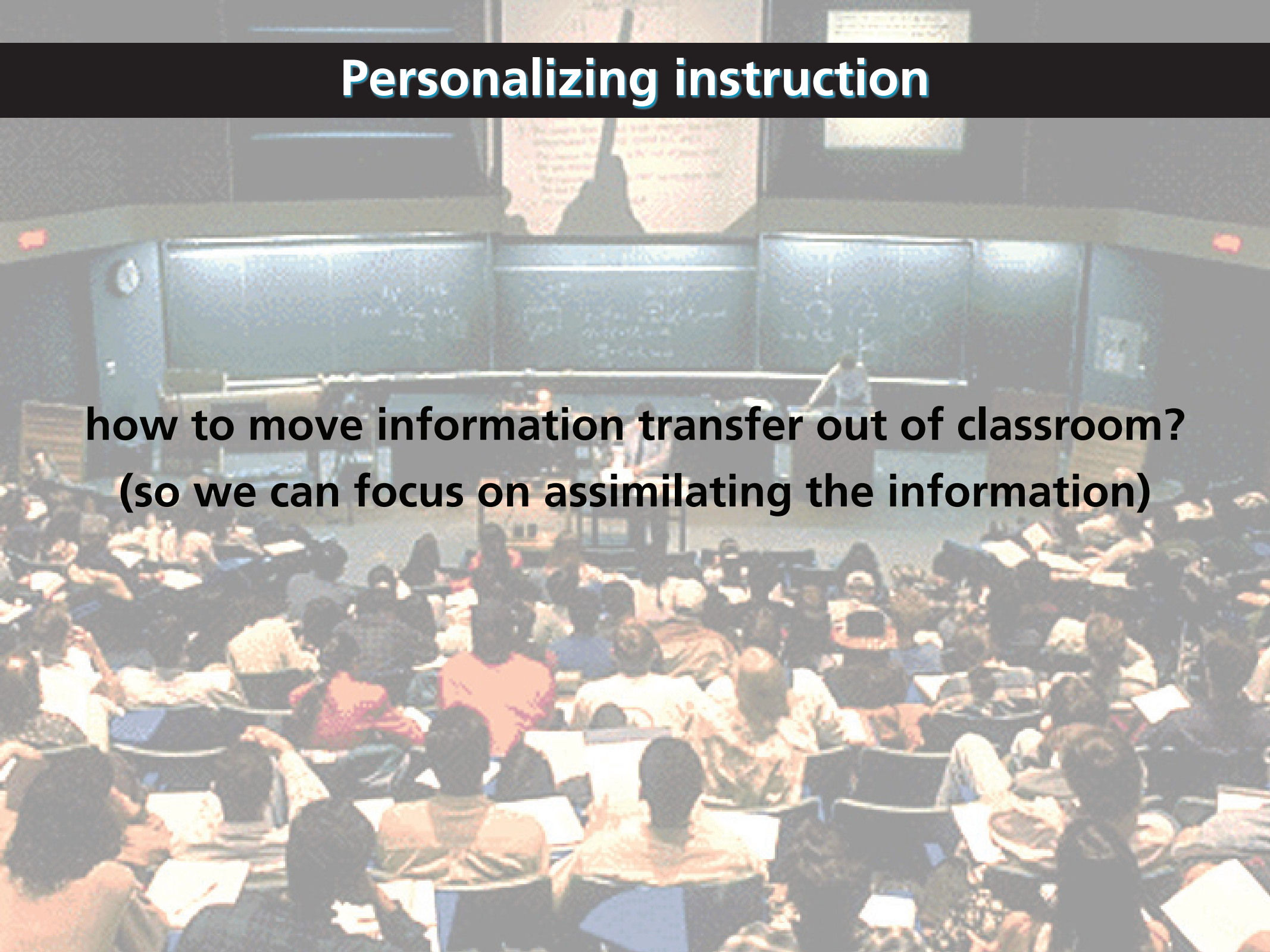
no time to think

Personalizing instruction



how to move information transfer out of classroom?

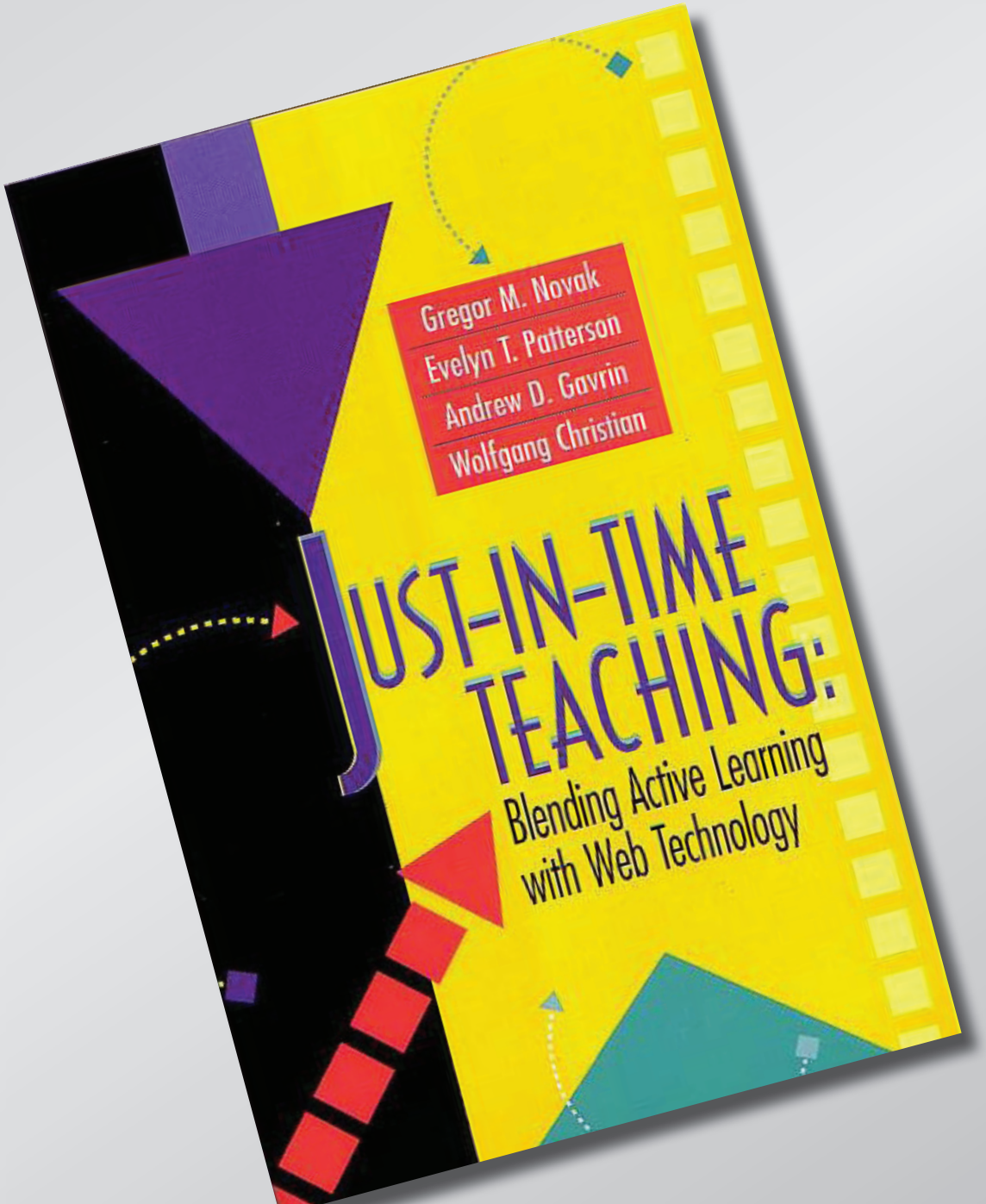
Personalizing instruction



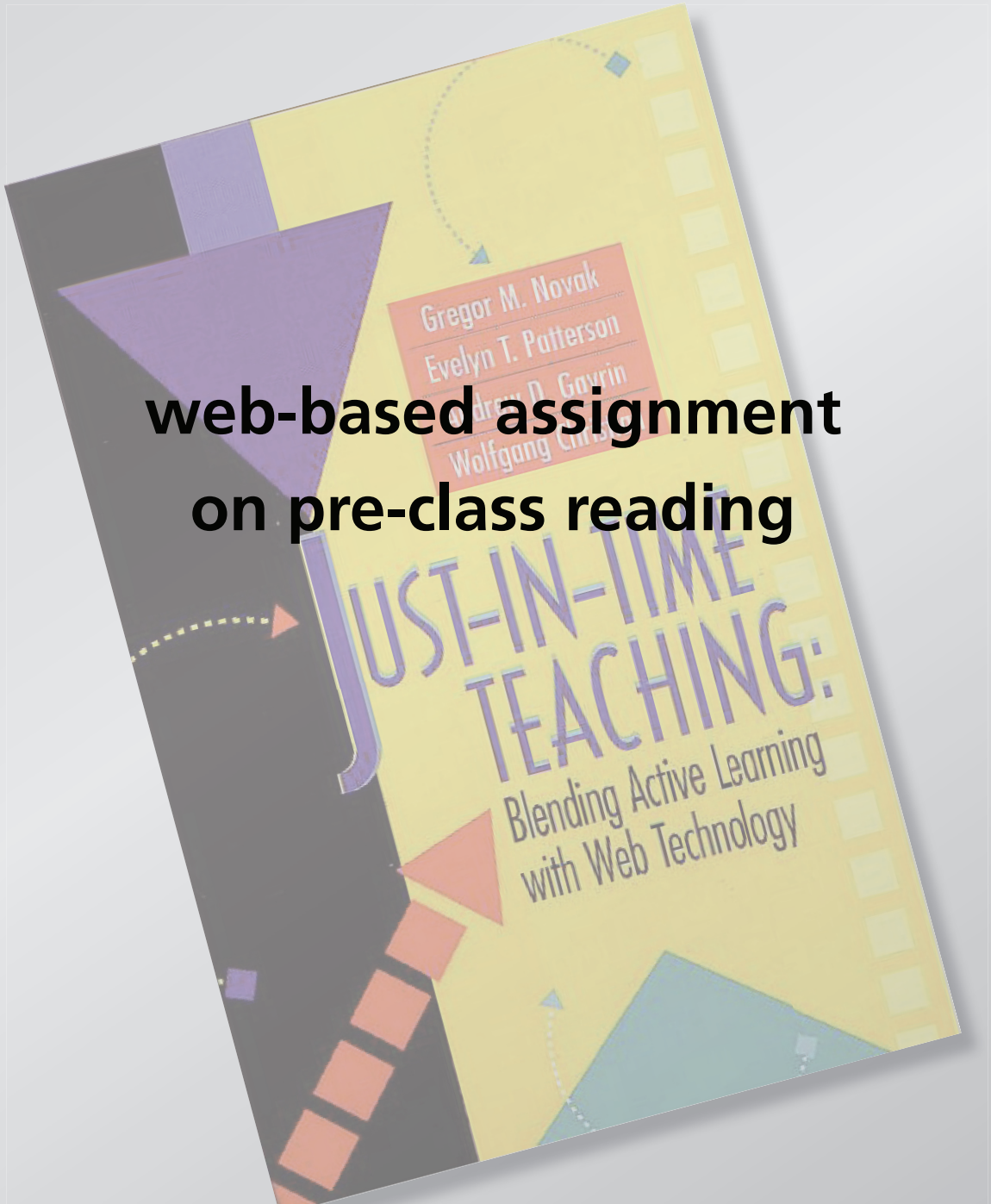
how to move information transfer out of classroom?

(so we can focus on assimilating the information)

Personalizing instruction



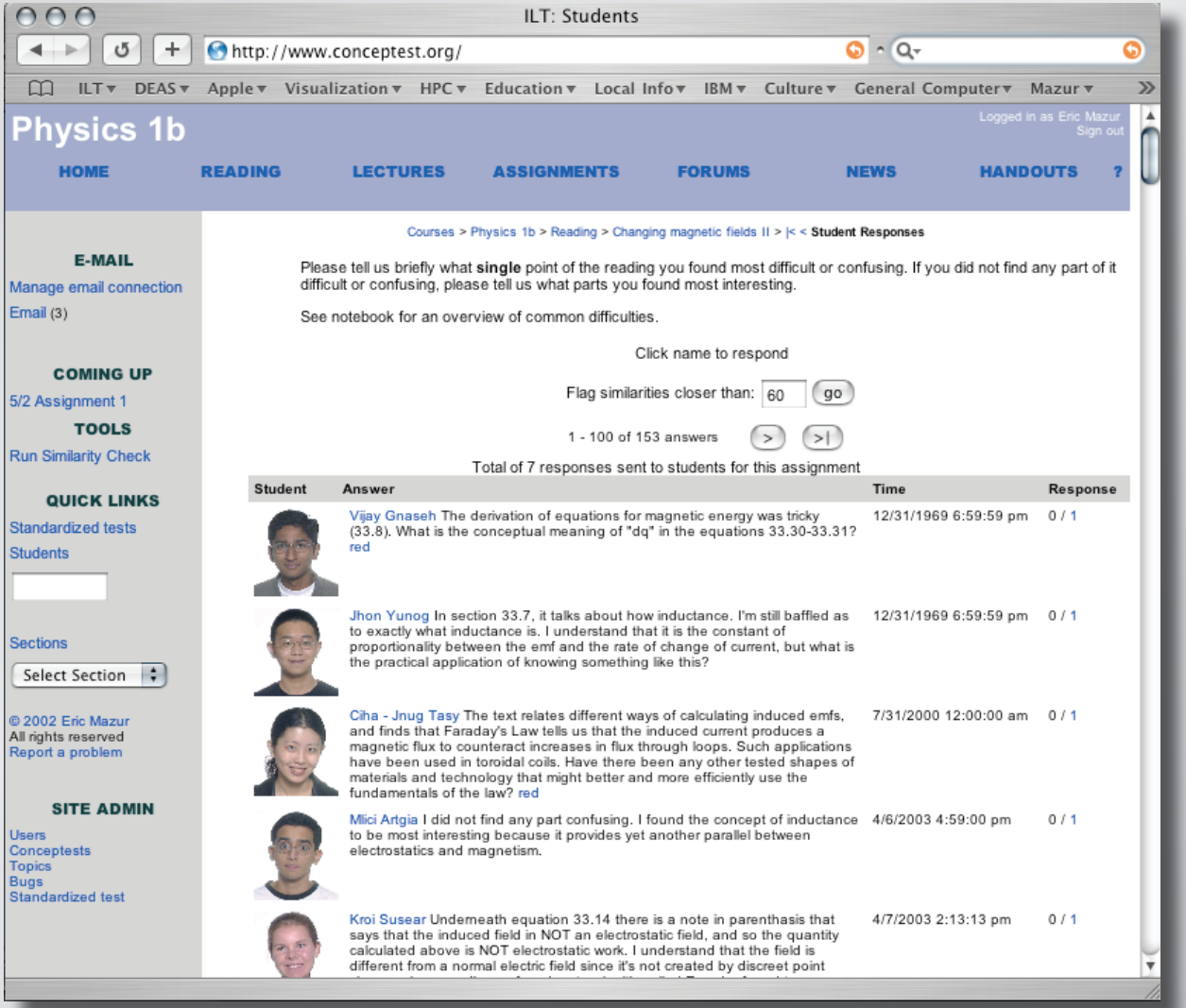
Personalizing instruction



web-based assignment

on pre-class reading

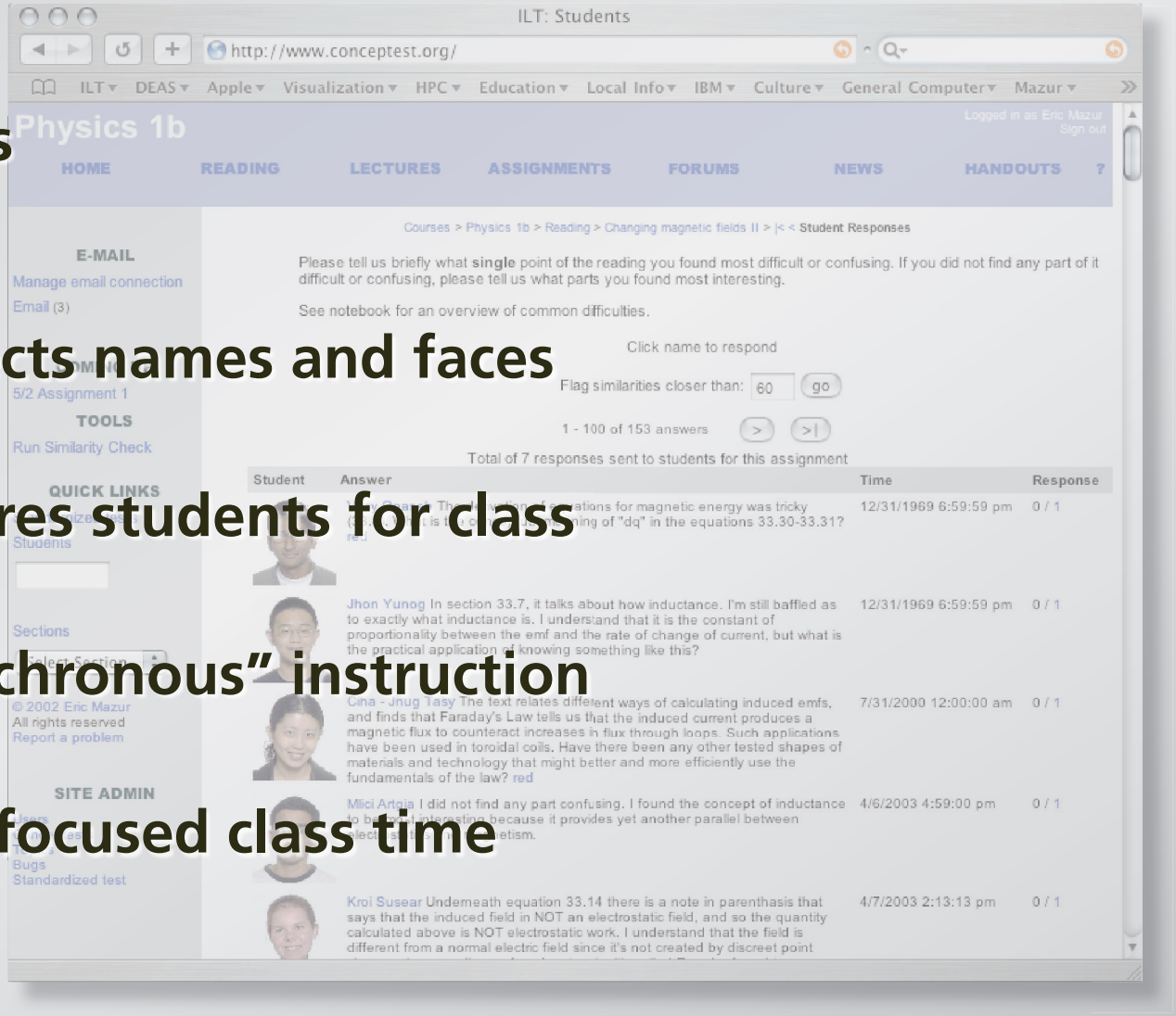
Personalizing instruction



Personalizing instruction

Benefits

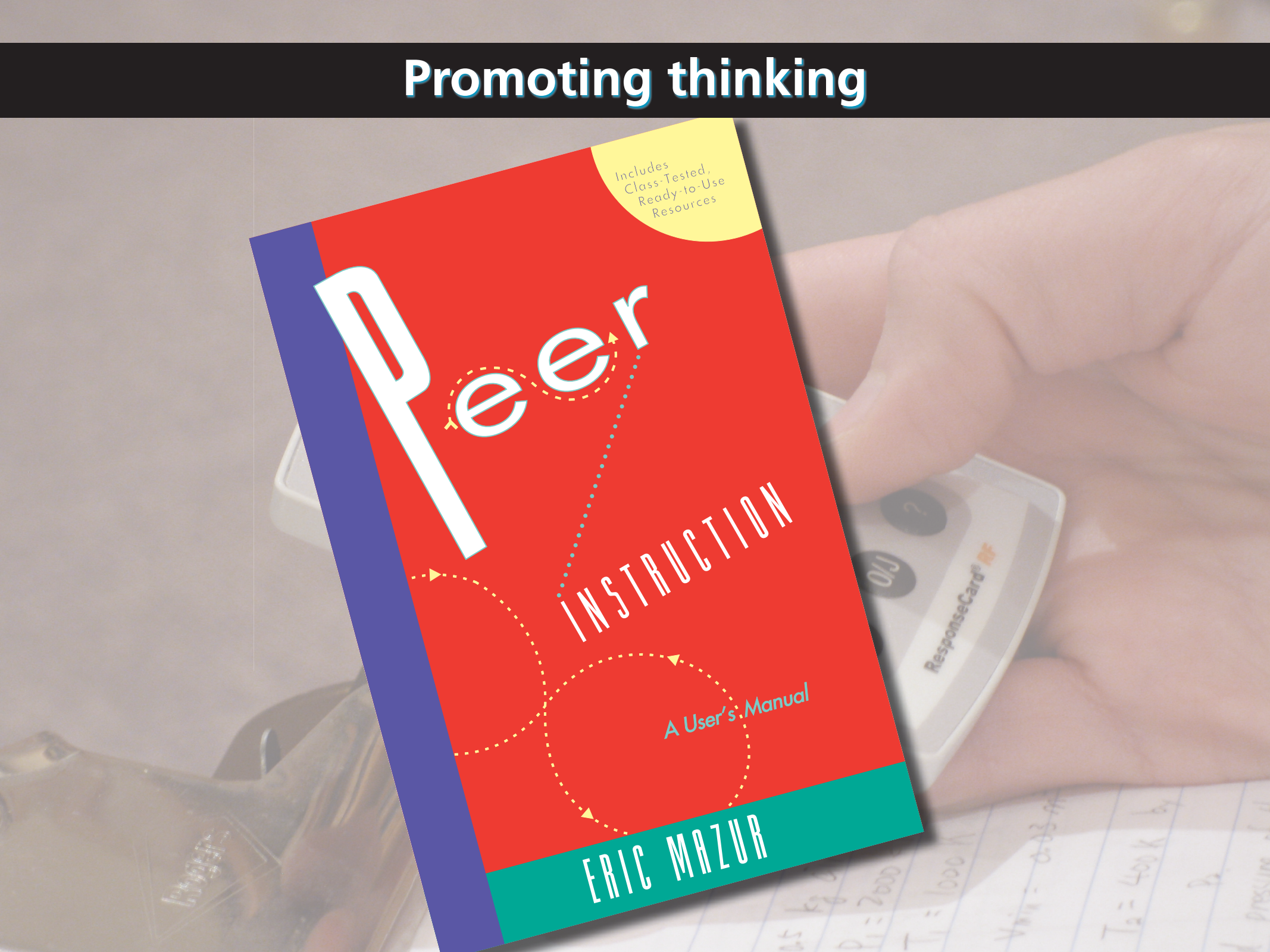
- connects names and faces
- prepares students for class
- “asynchronous” instruction
- more focused class time



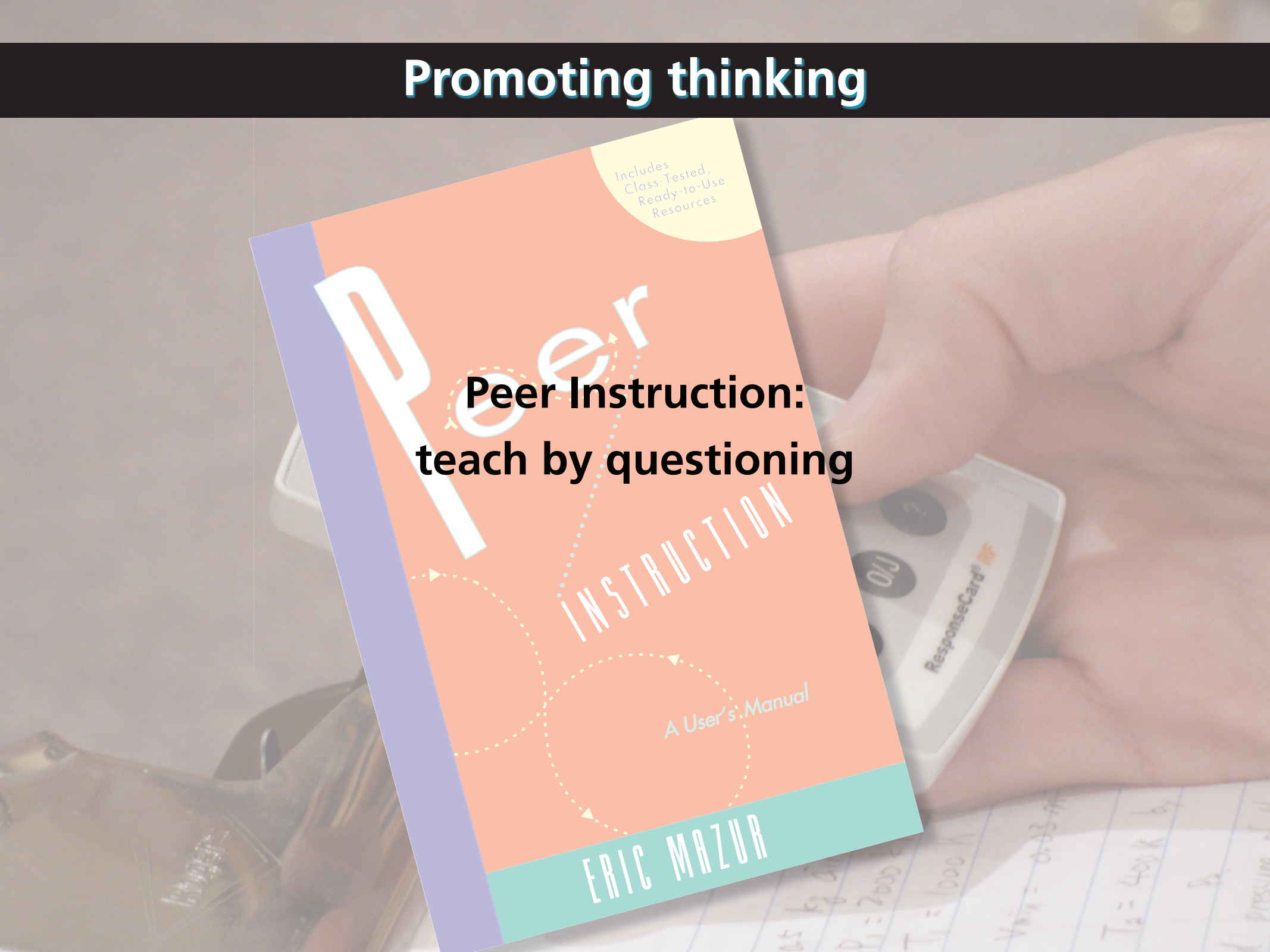
Outline

- Personalizing instruction
- **Promoting thinking**
- Integrating instruction

Promoting thinking

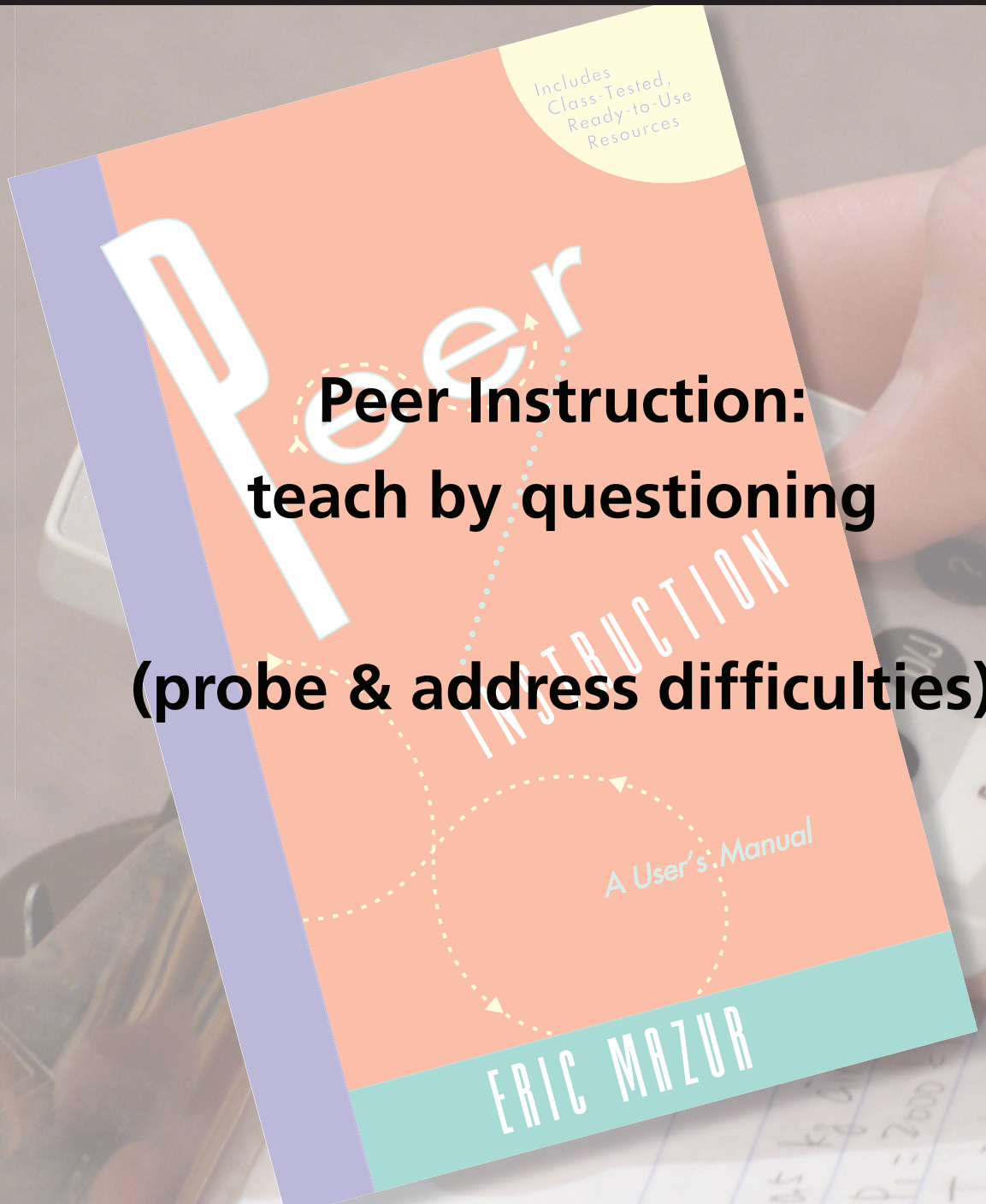


Promoting thinking



Peer Instruction:
teach by questioning

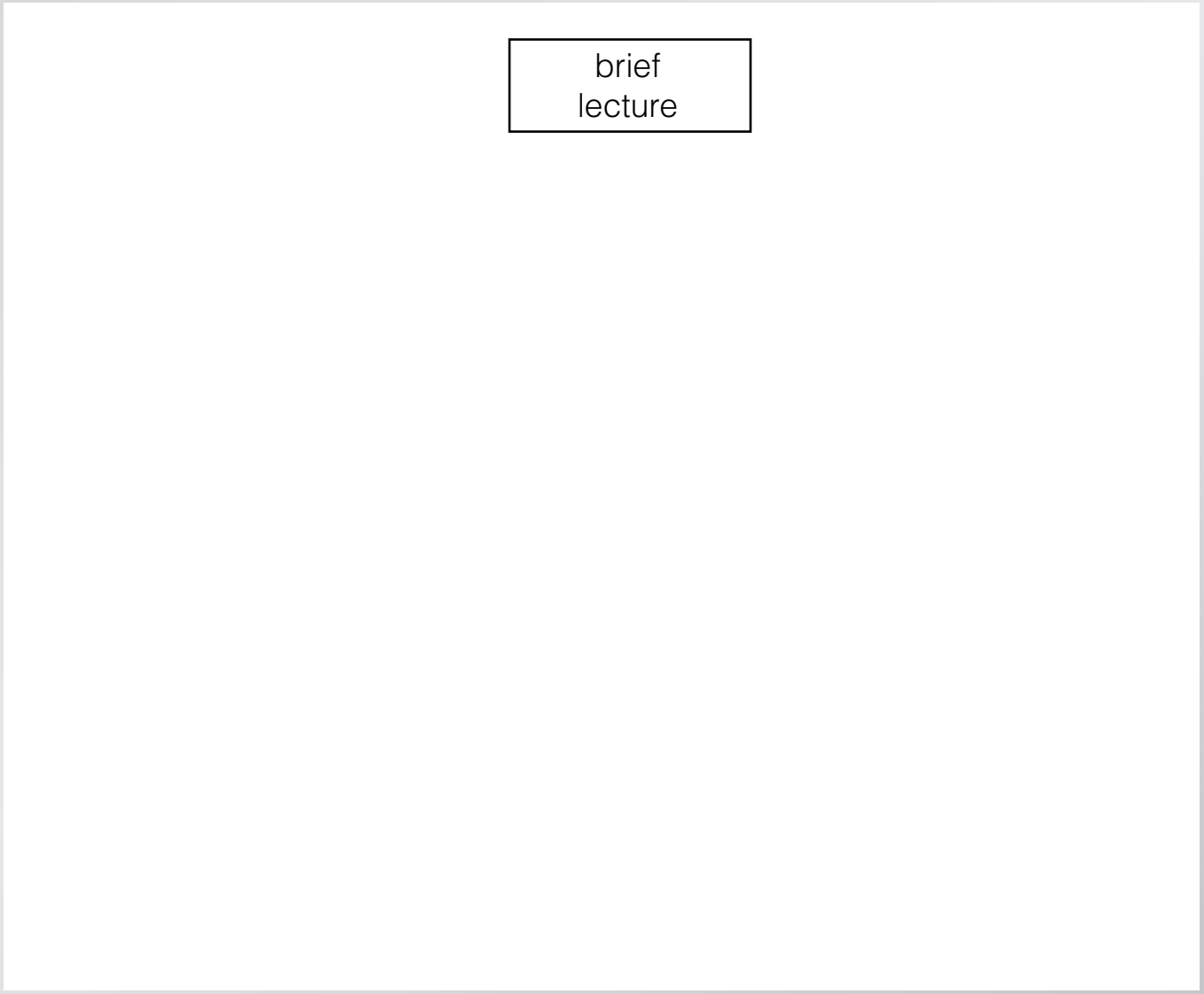
Promoting thinking



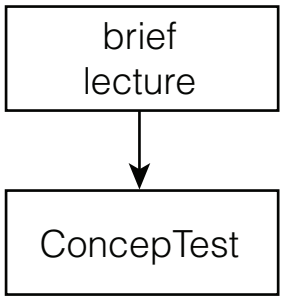
Peer Instruction:
teach by questioning

(probe & address difficulties)

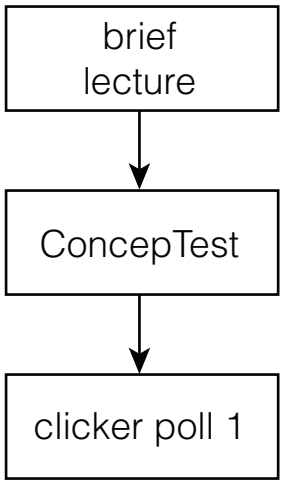
Promoting thinking



Promoting thinking



Promoting thinking



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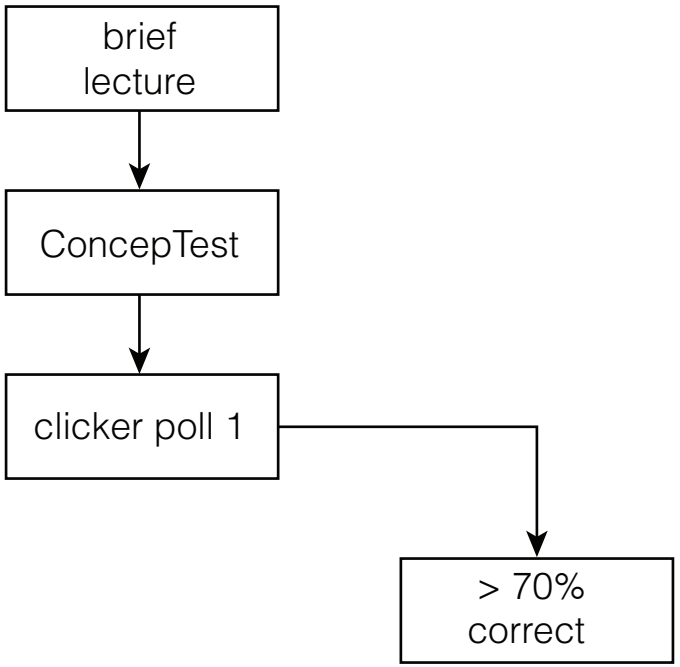

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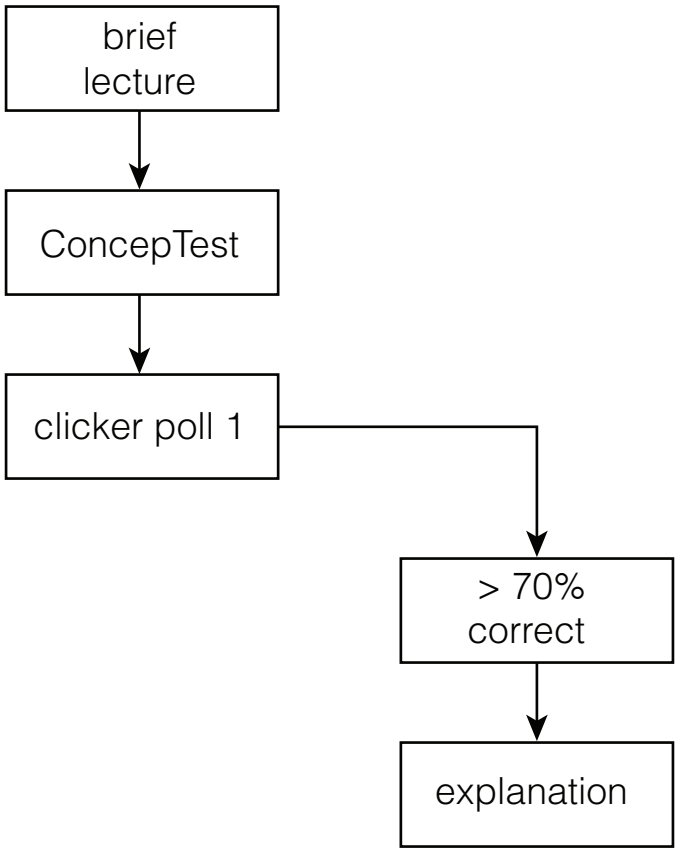

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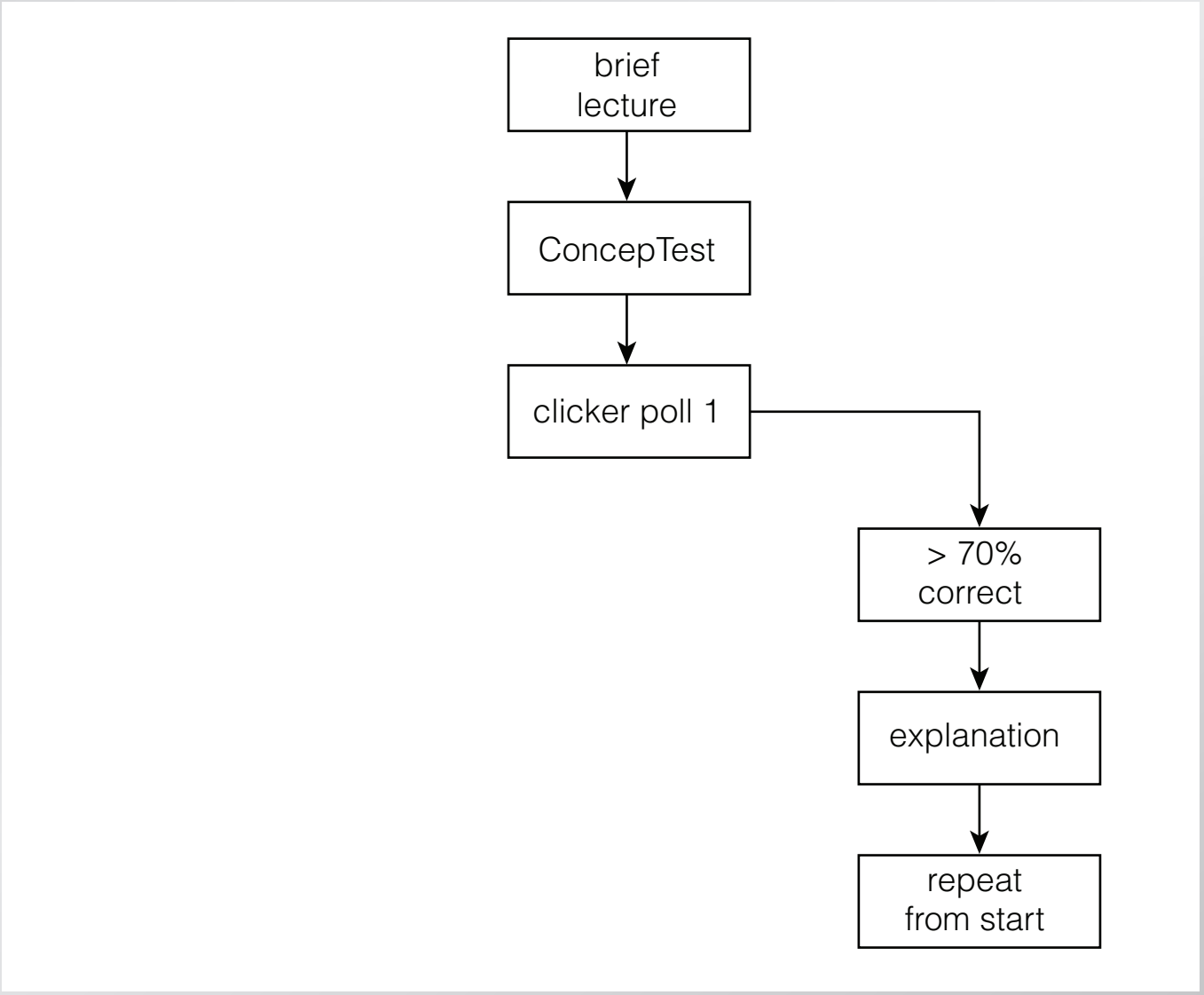

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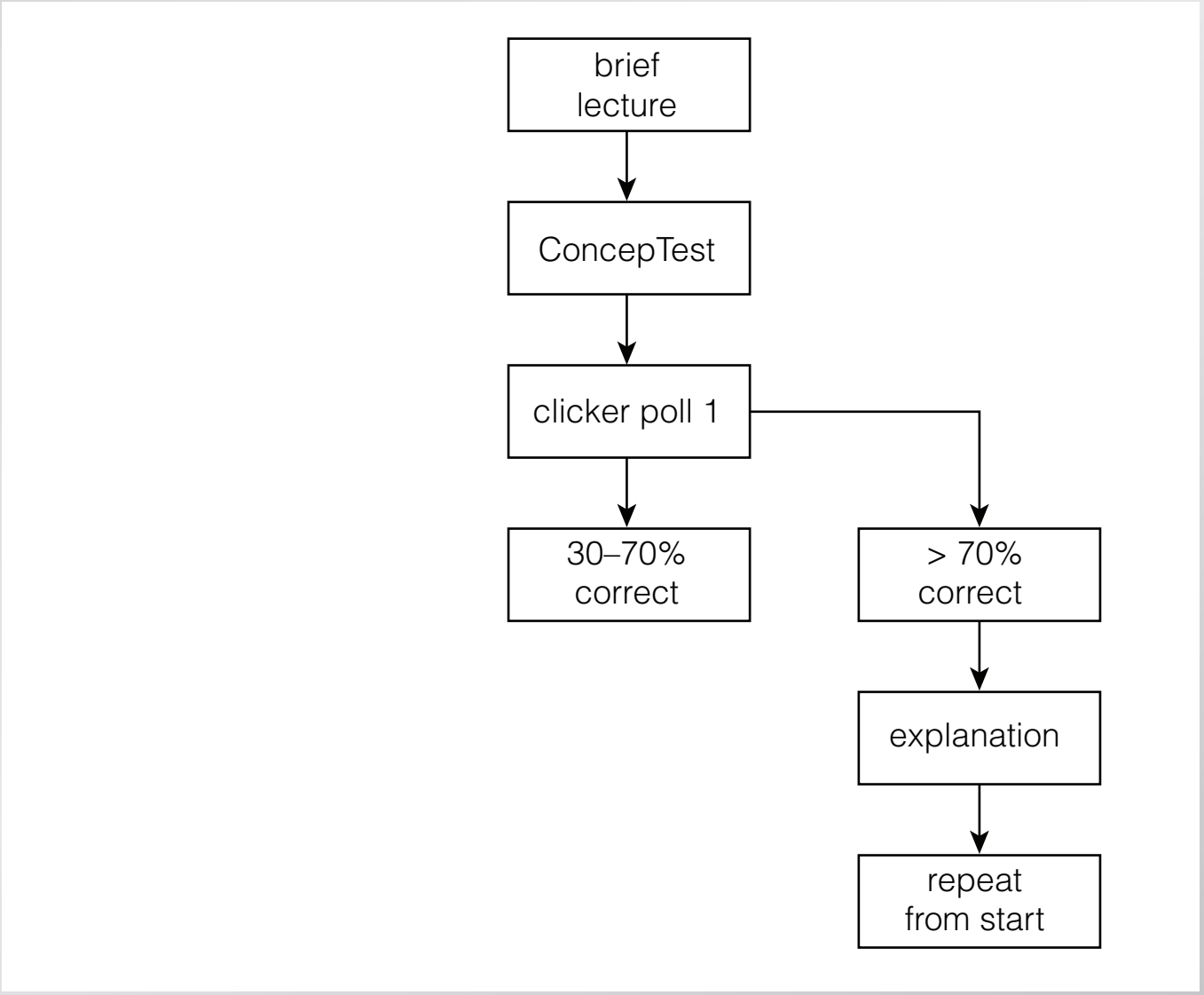

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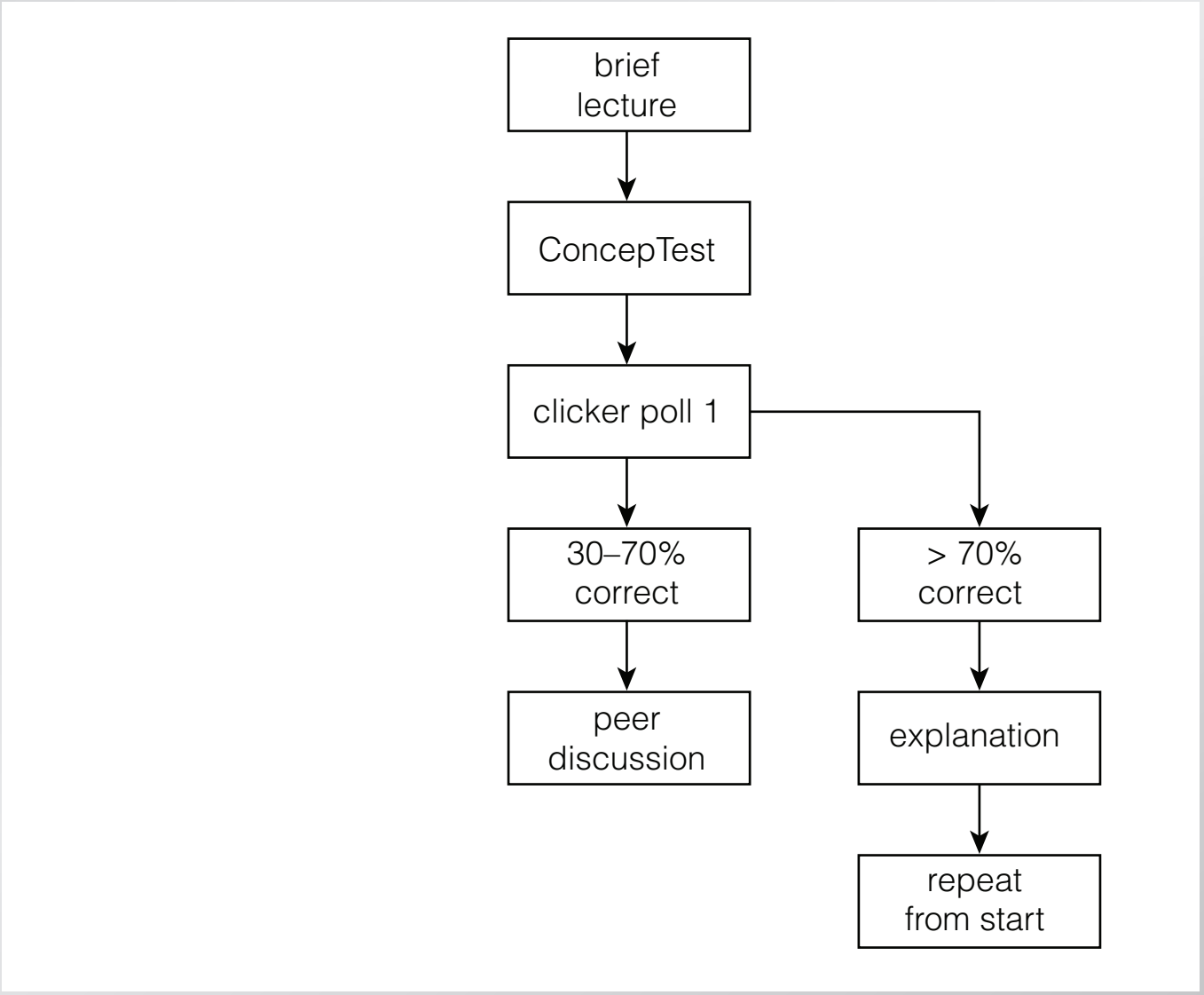

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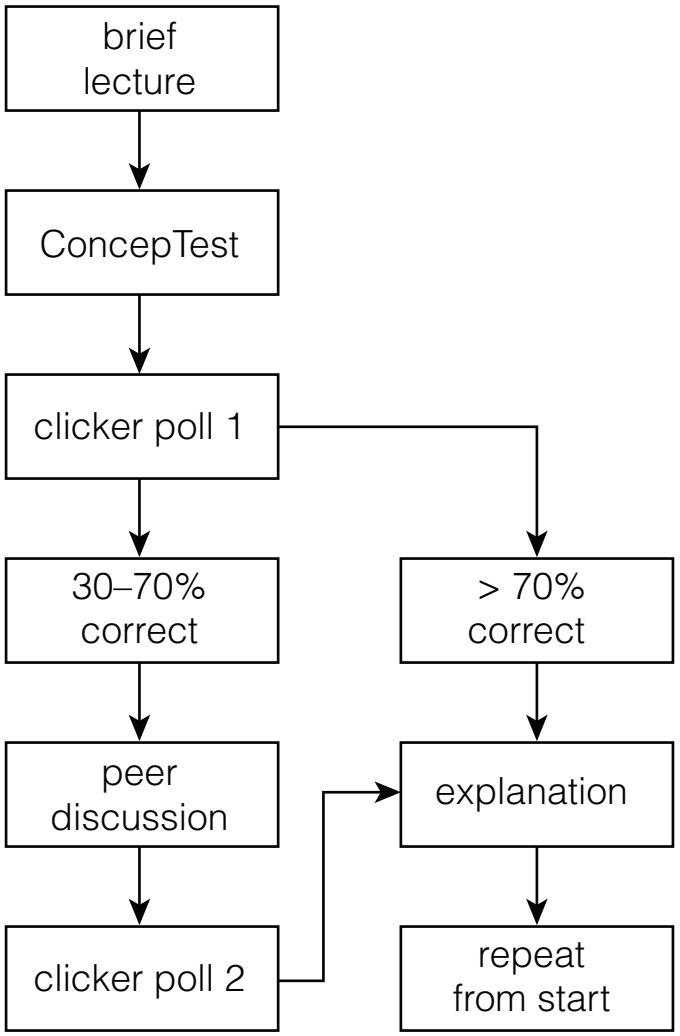

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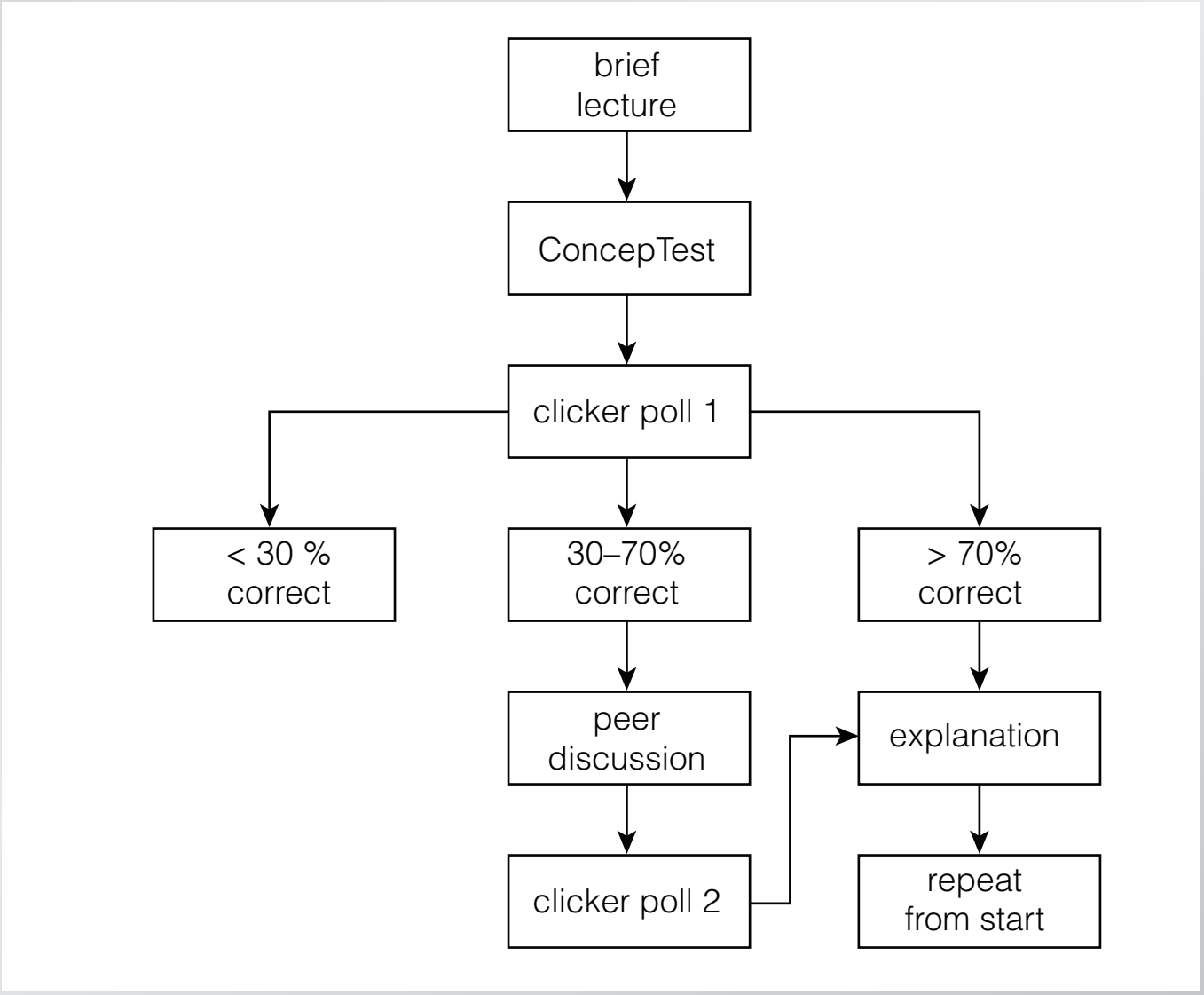

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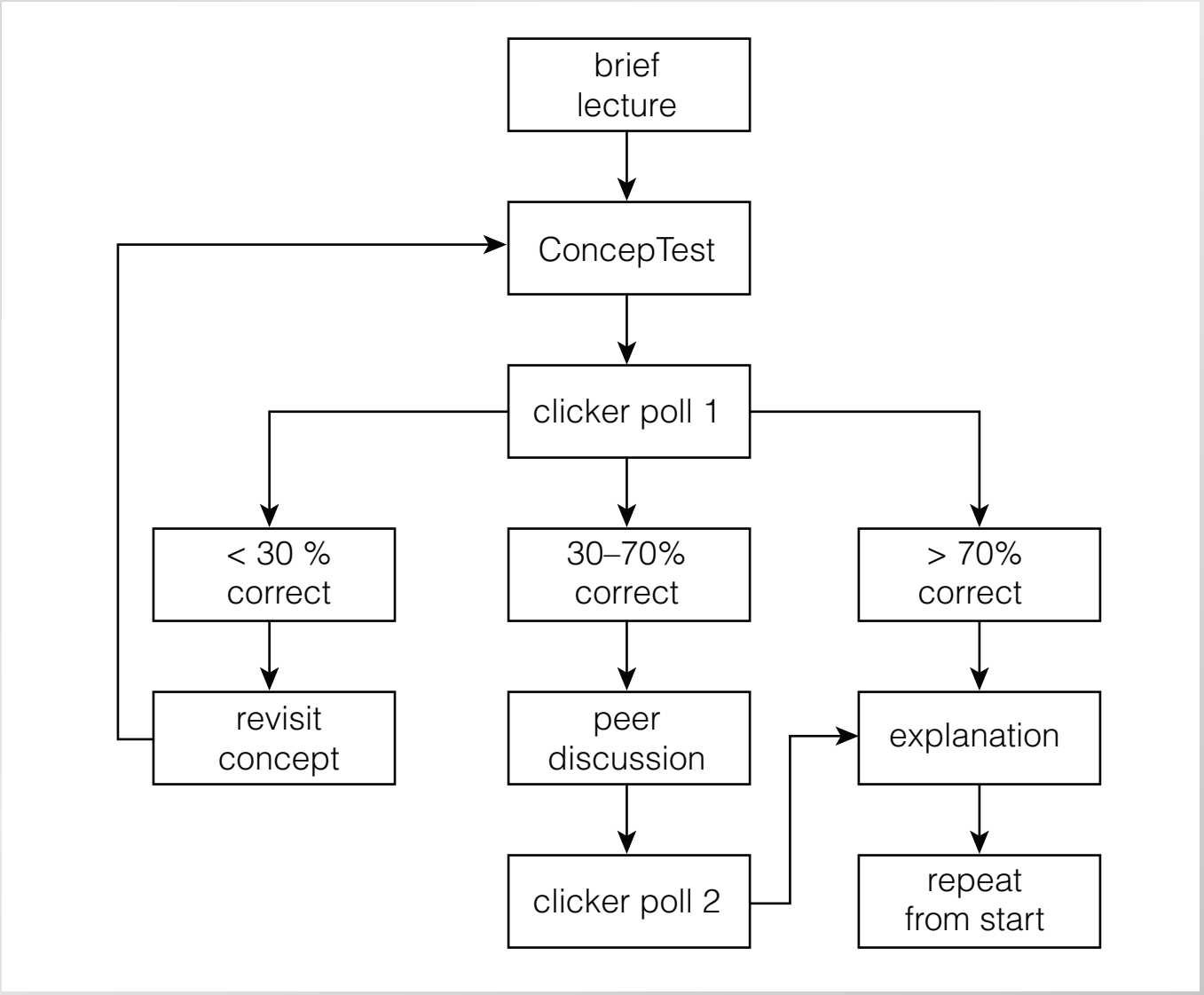

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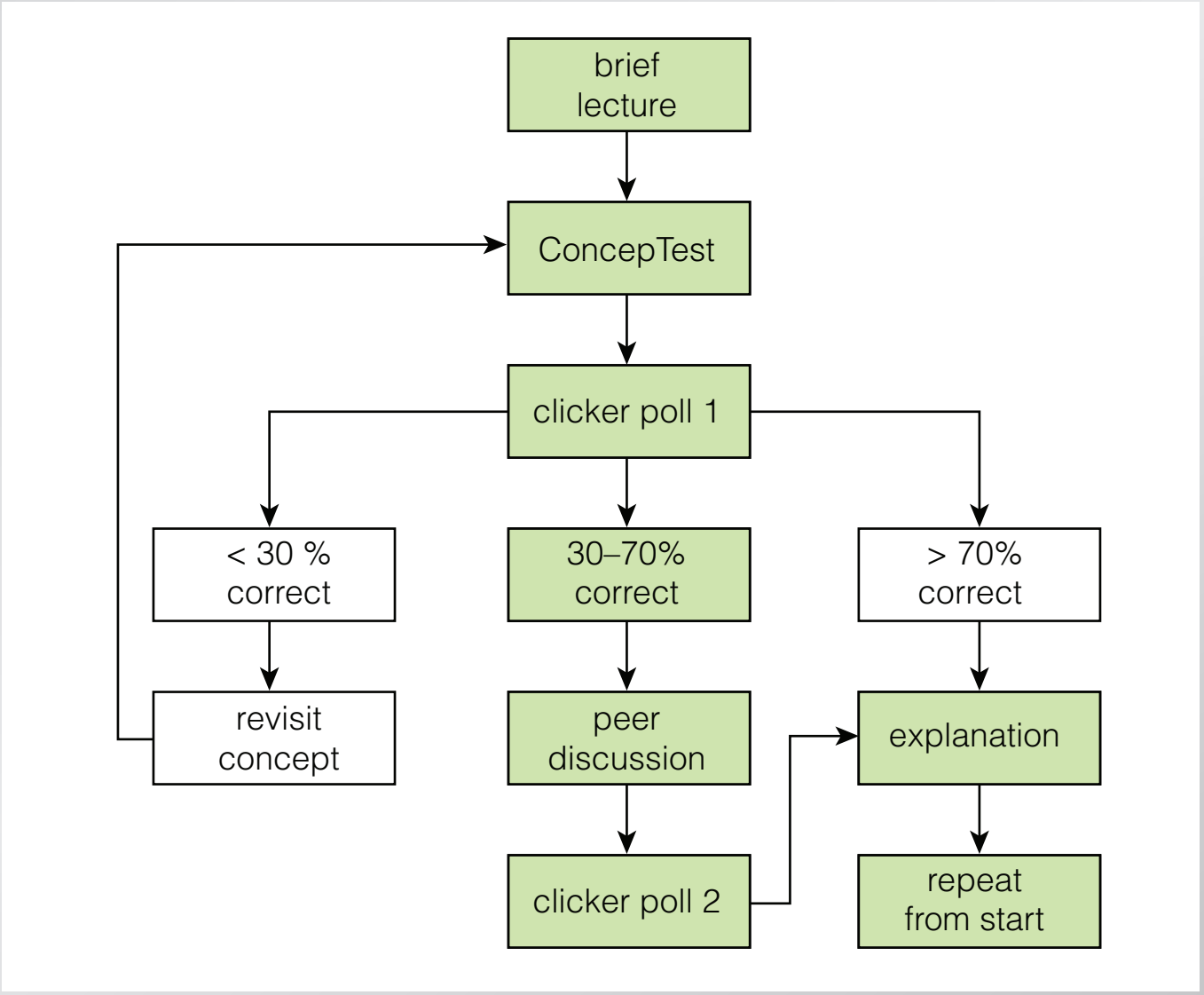


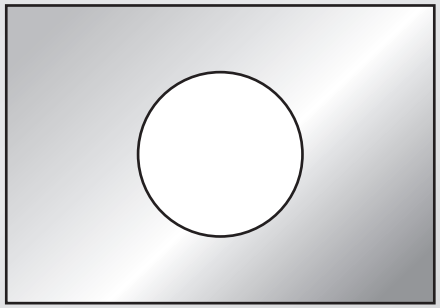
Promoting thinking

- no ON/OFF button
- only last “click” counts
- display shows recorded answer

www.TurningTechnologies.com

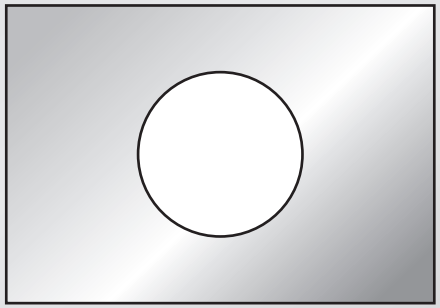
Promoting thinking

Consider a rectangular metal plate with a circular hole in it.



Promoting thinking

Consider a rectangular metal plate with a circular hole in it.

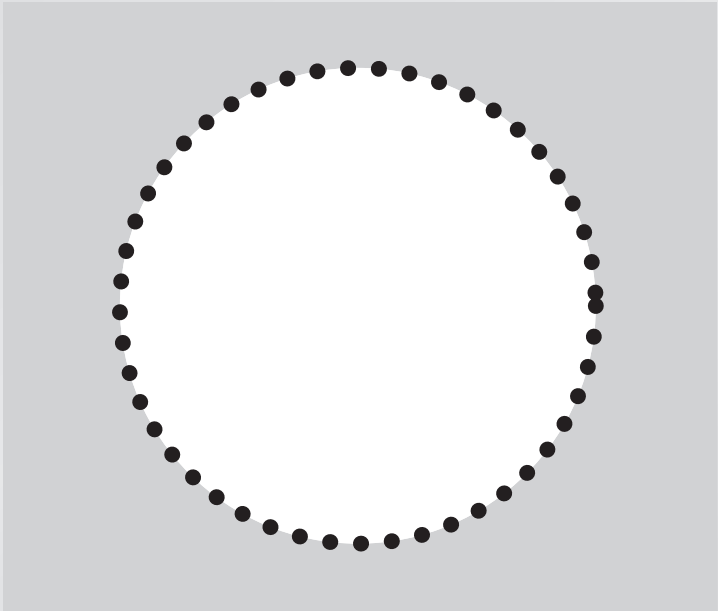


When the plate is uniformly heated, the diameter of the hole

1. increases.
2. stays the same.
3. decreases.

Promoting thinking

consider the atoms at the rim of the hole



Promoting thinking

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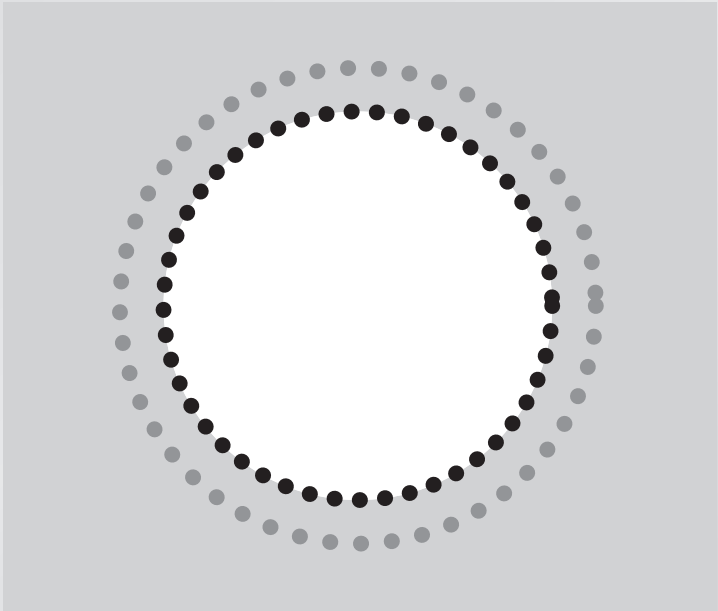

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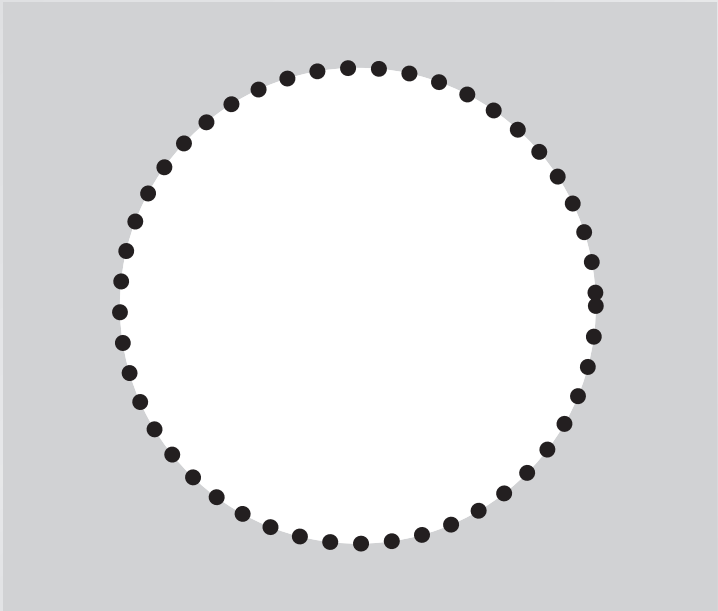

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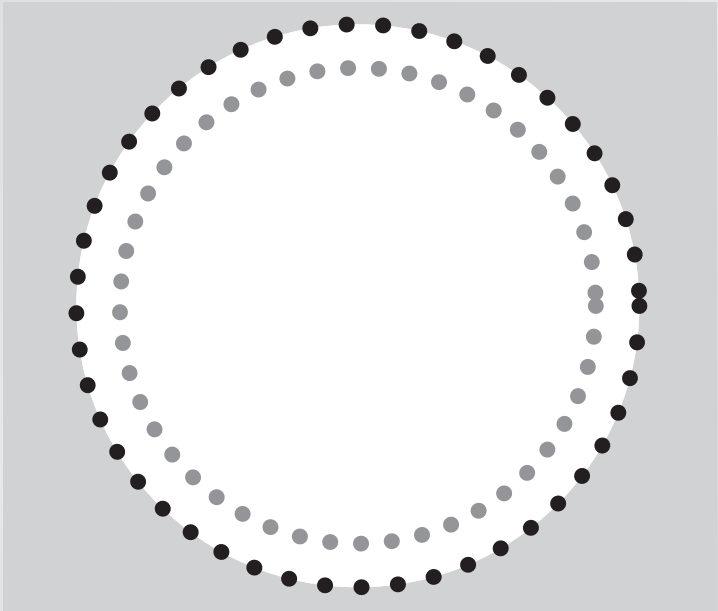
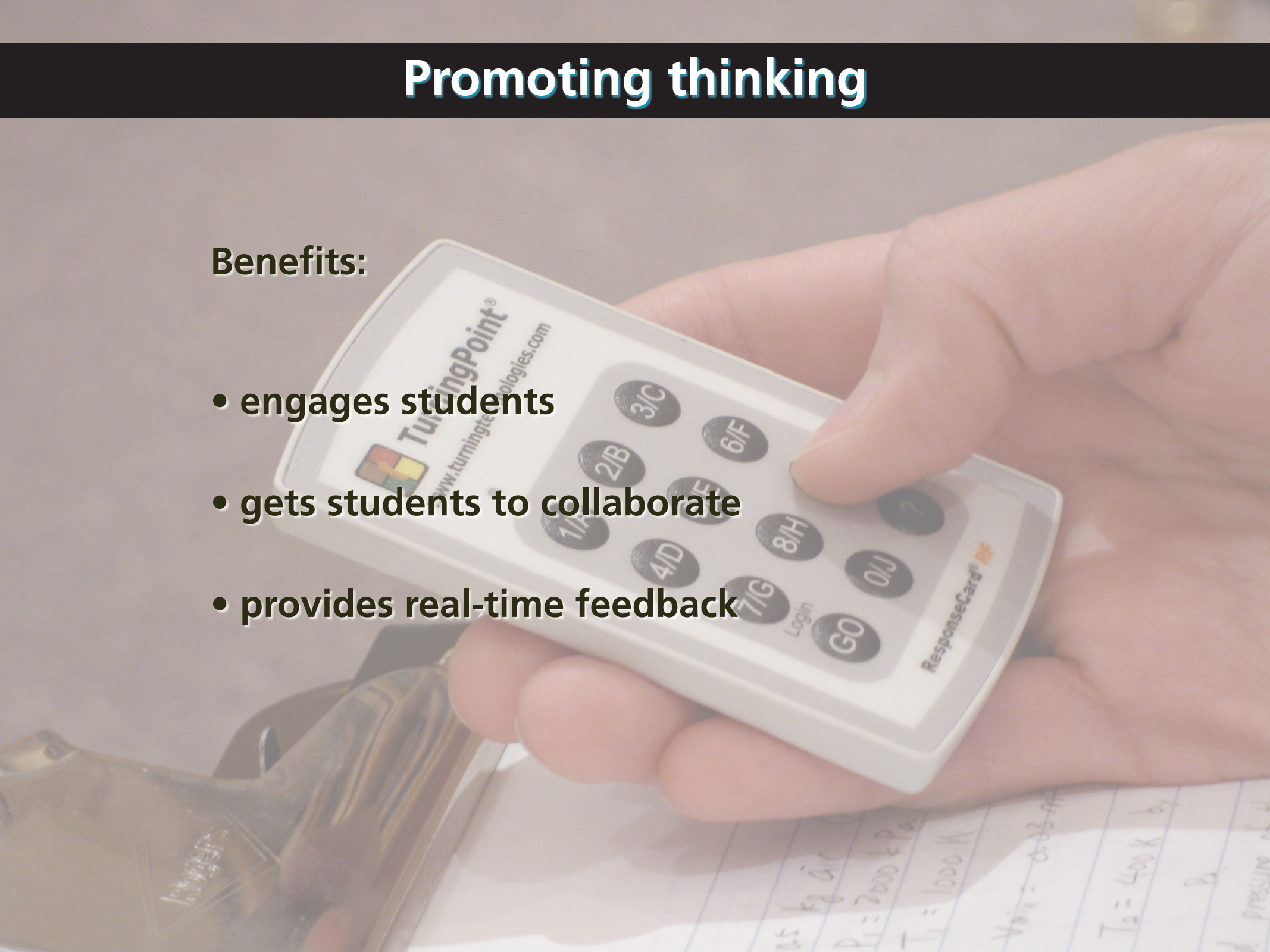


Promoting thinking

you all got engaged!

Promoting thinking



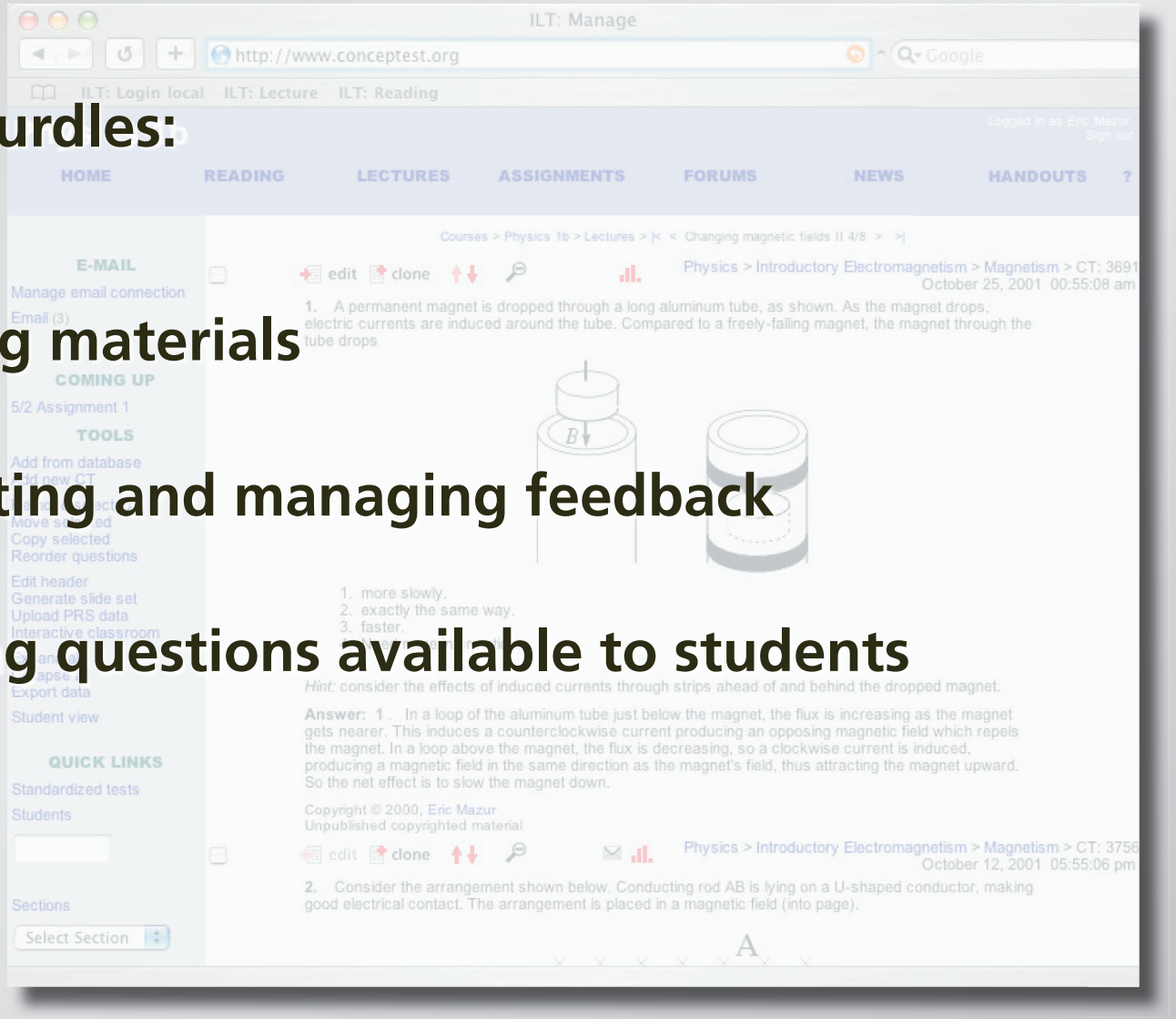
Benefits:

- engages students
- gets students to collaborate
- provides real-time feedback

Promoting thinking

Some hurdles:

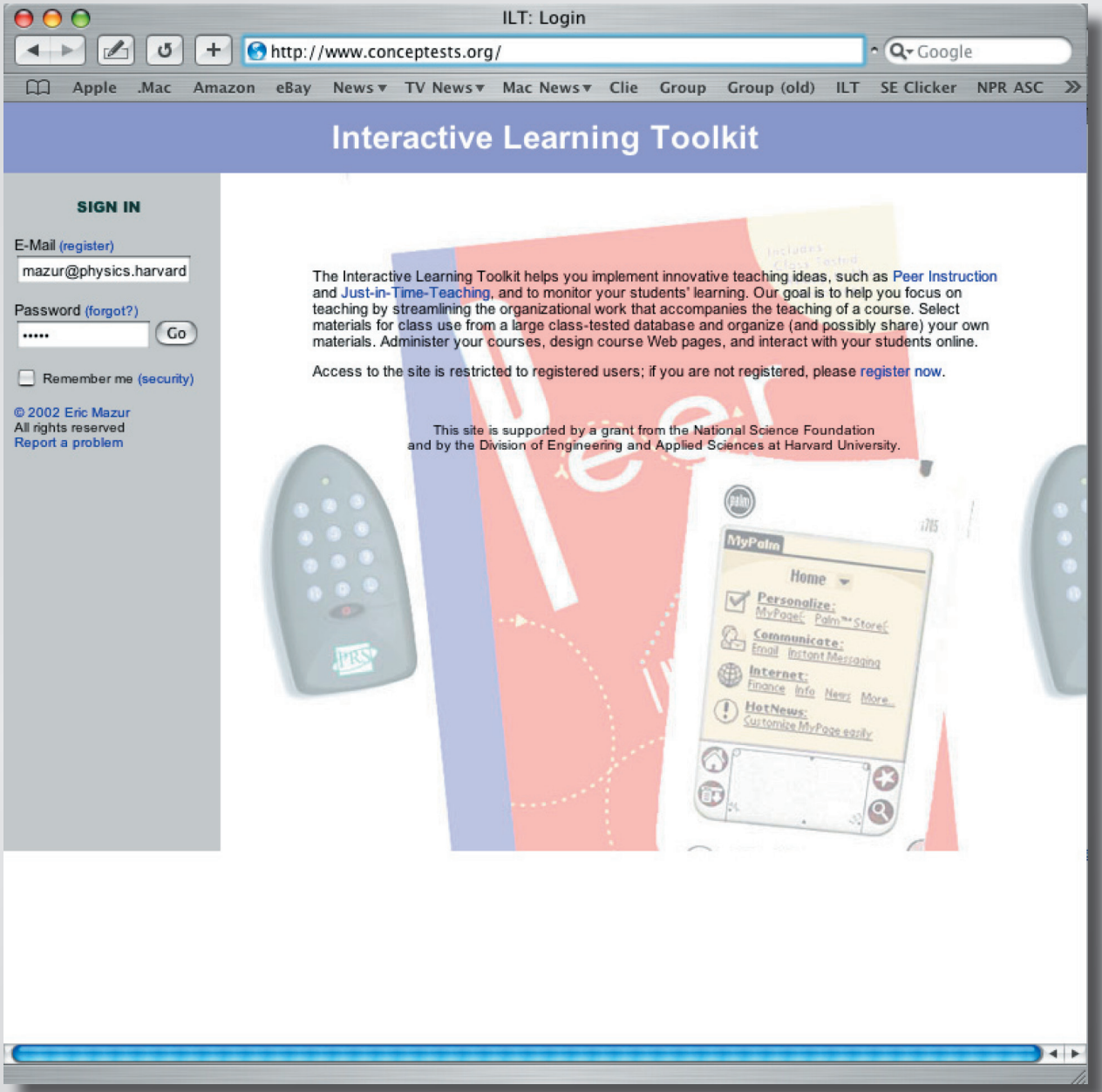
- finding materials
- collecting and managing feedback
- making questions available to students



Outline

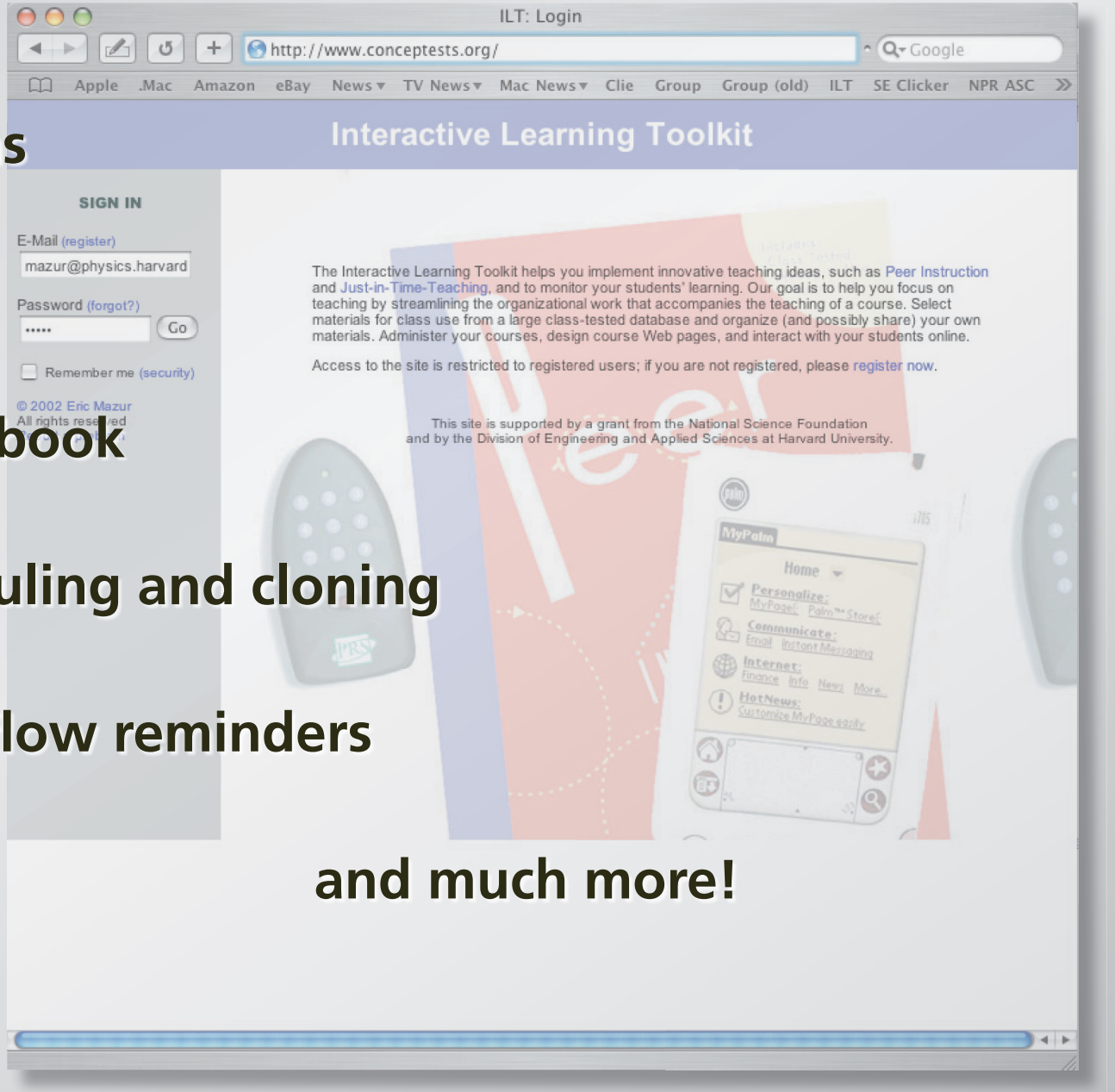
- Personalizing instruction
- Promoting thinking
- Integrating instruction

Integrating instruction



Integrating instruction

- forums
- email
- gradebook
- scheduling and cloning
- workflow reminders

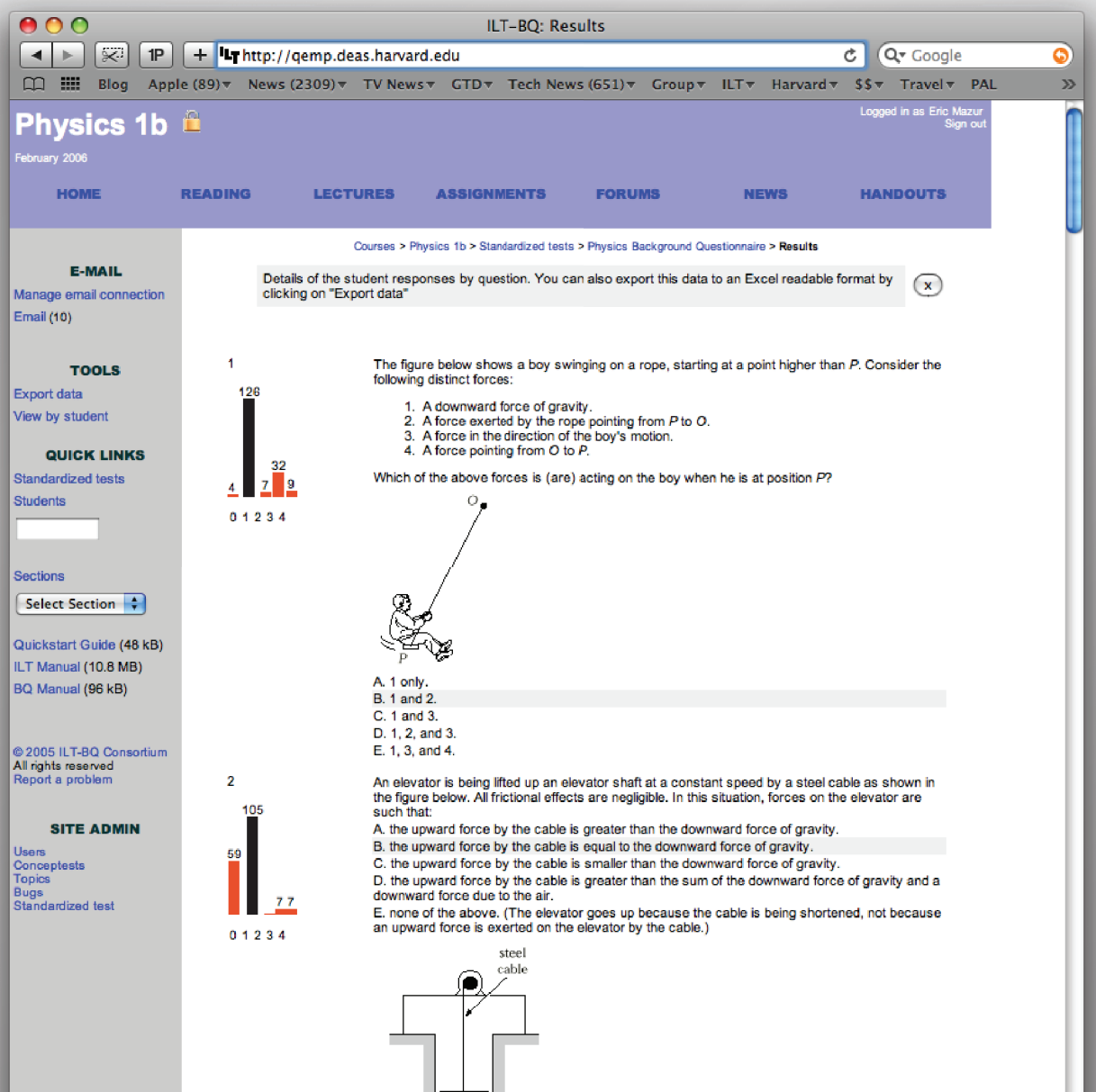


and much more!

Integrating instruction

online assessment module

- easy to administer
- easy to implement
- easy results!



Integrating instruction

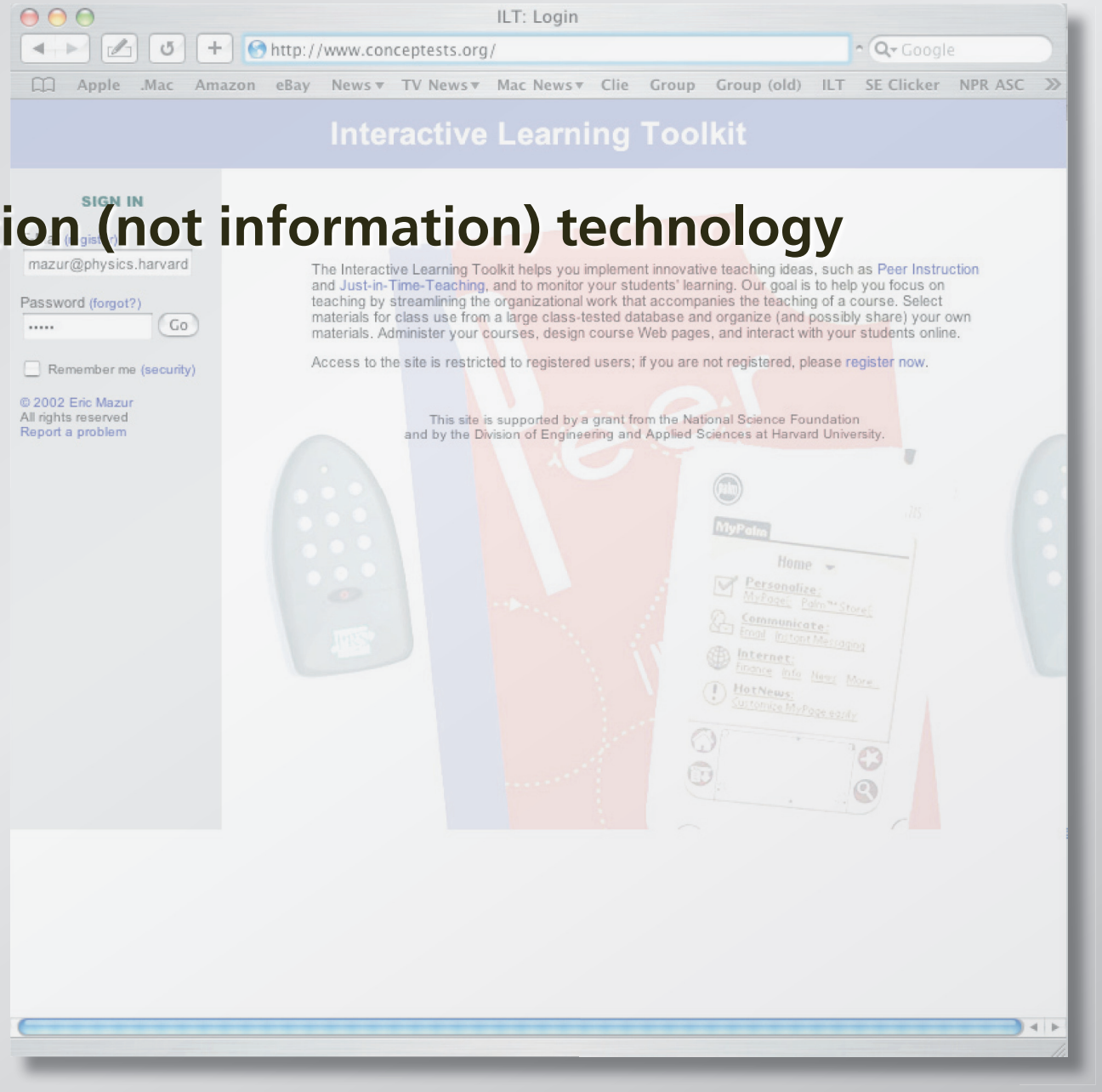
Available assessment instruments

- Force Concept Inventory
- Conceptual Survey on Electricity and Magnetism
- Lawson's test for scientific reasoning
- Astronomy Diagnostic Test
- Maryland Physics Expectation Test

over 25,000 students tested!

Summary

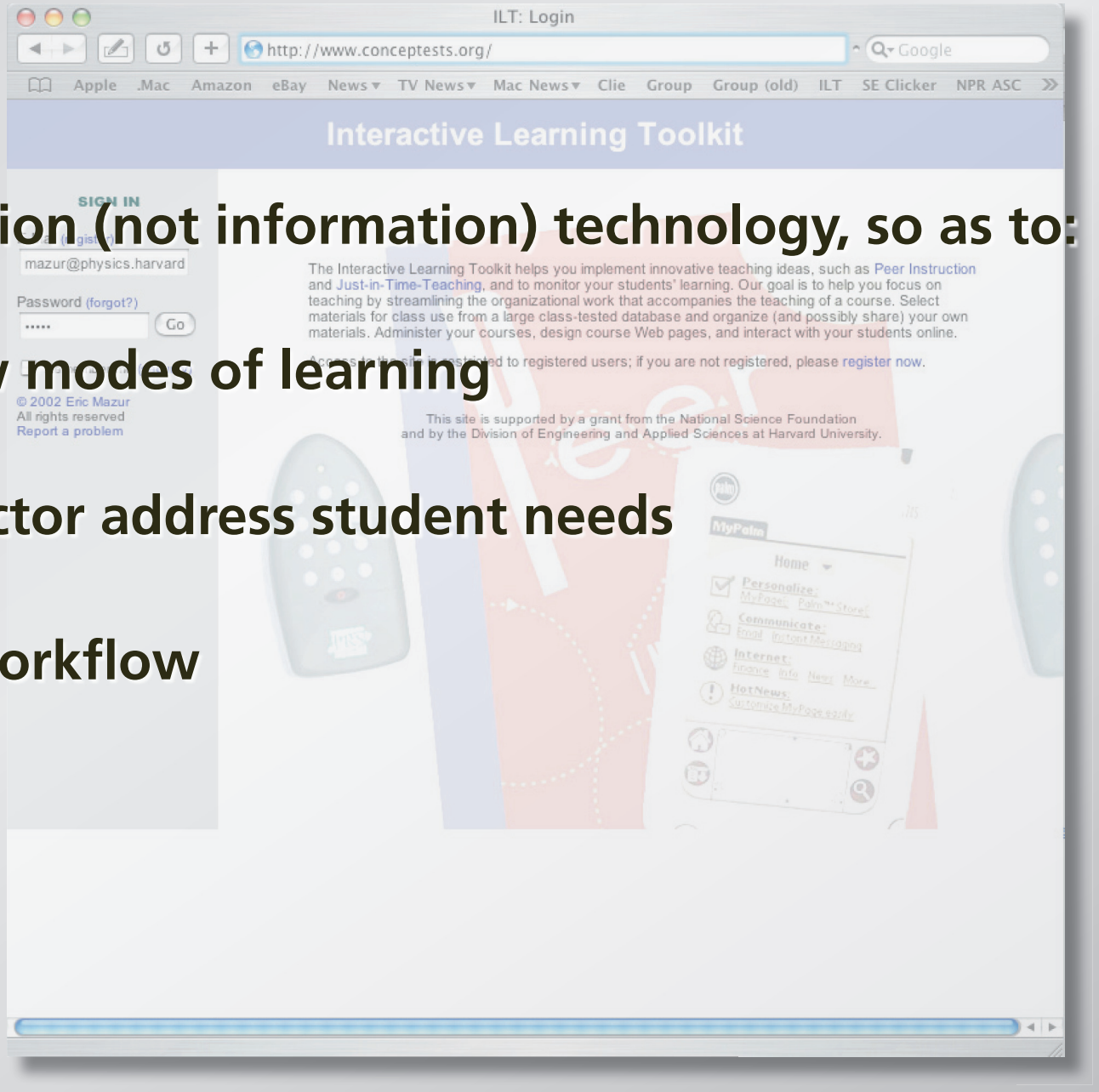
we need education (not information) technology



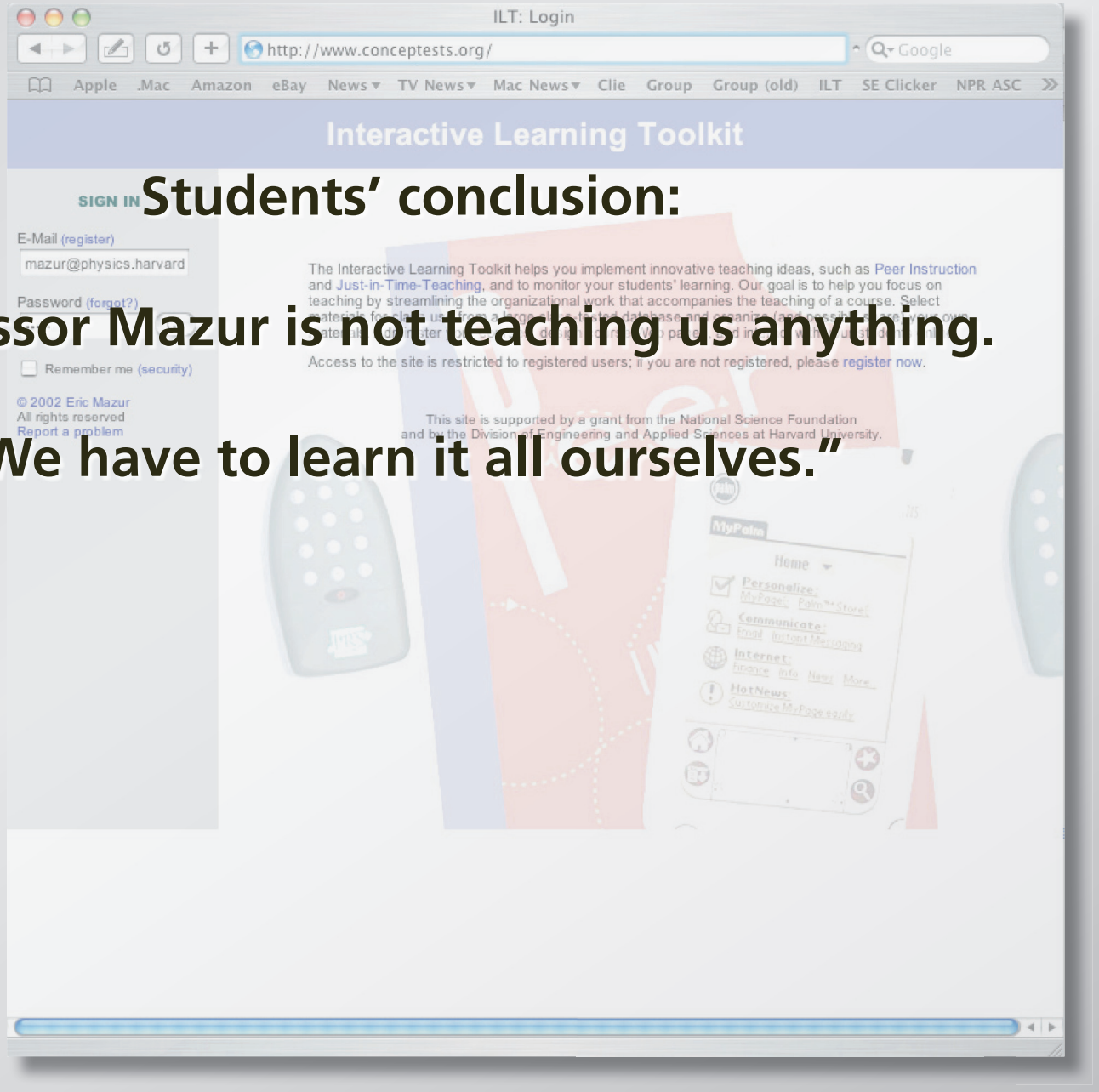
Summary

we need education (not information) technology, so as to:

- enable new modes of learning
- help instructor address student needs
- facilitate workflow



Summary



Students' conclusion:

"Professor Mazur is not teaching us anything.

We have to learn it all ourselves."

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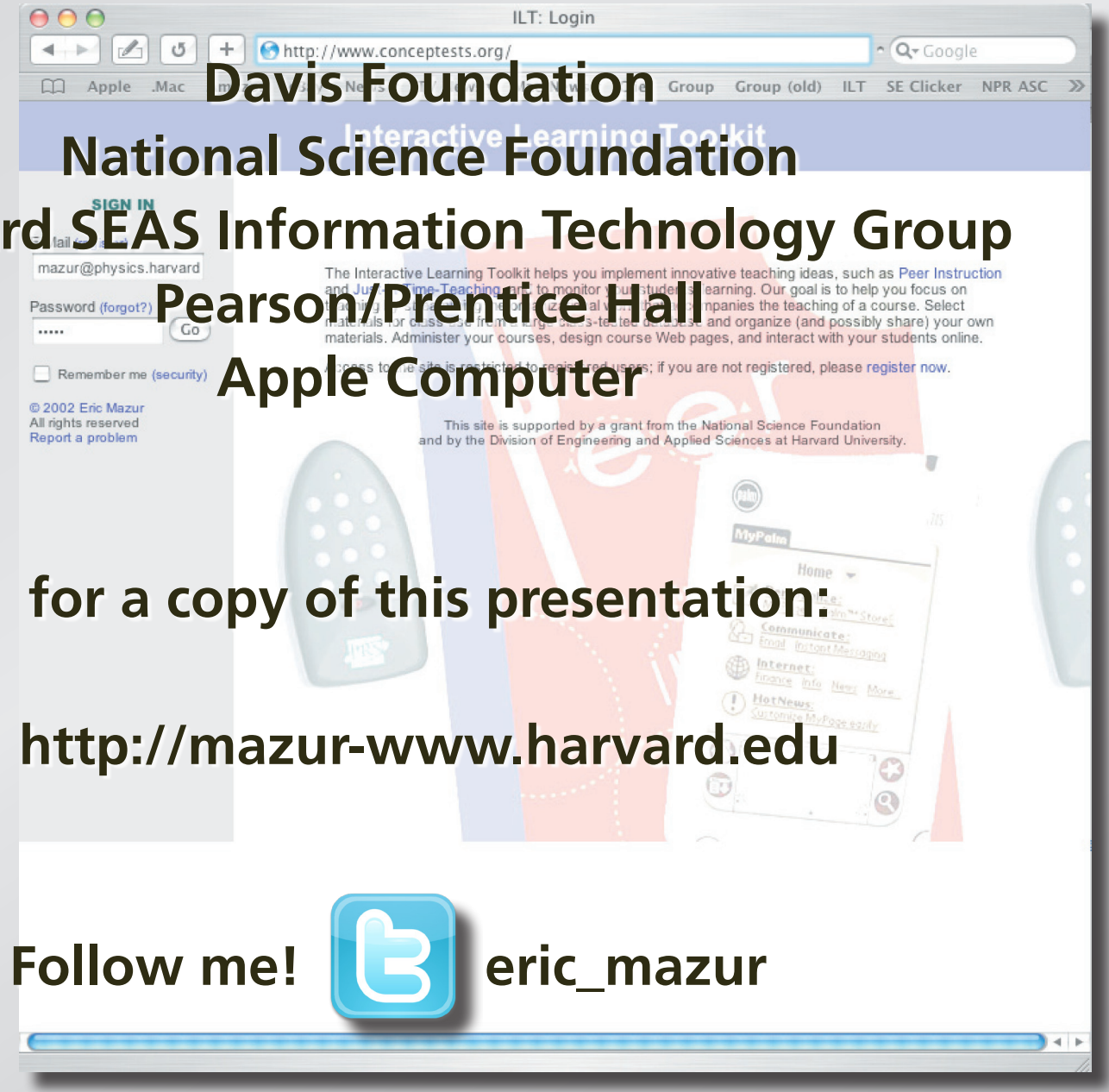

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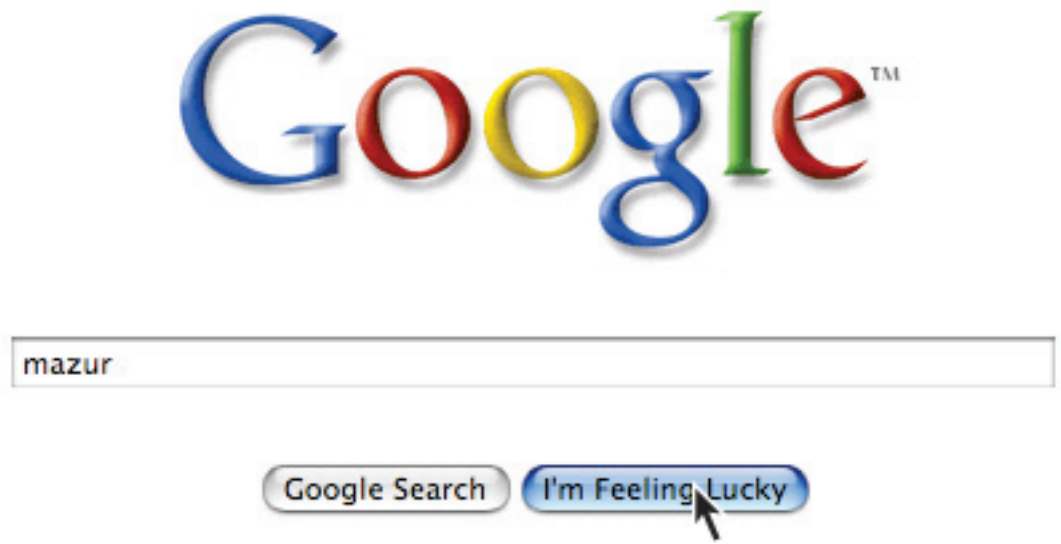
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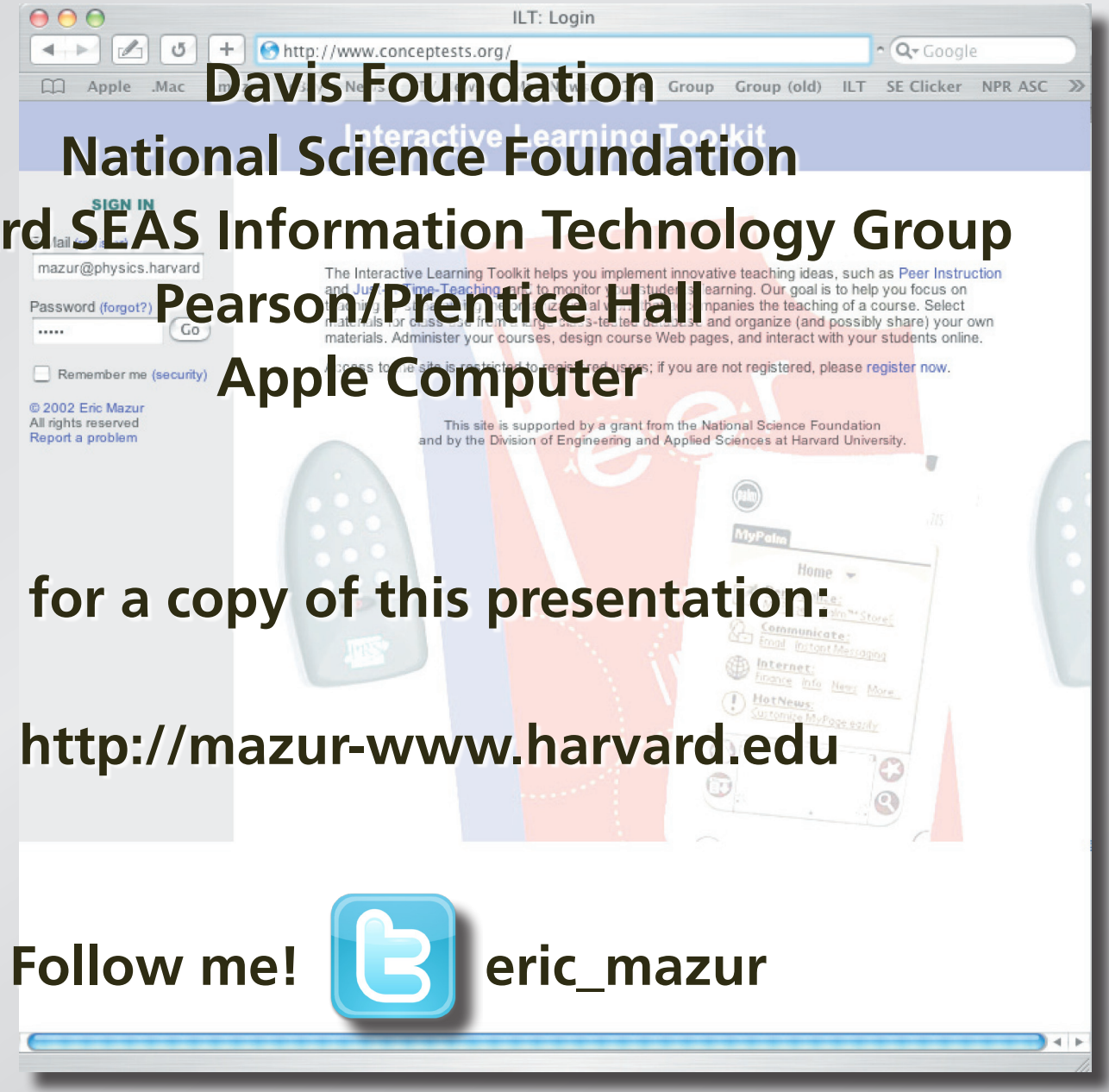

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