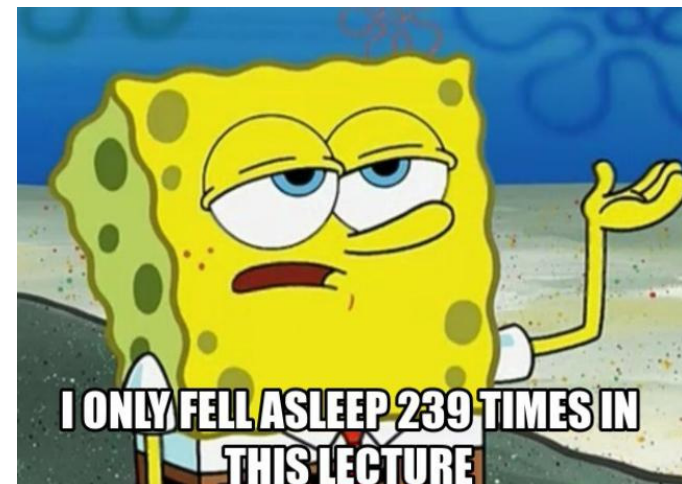
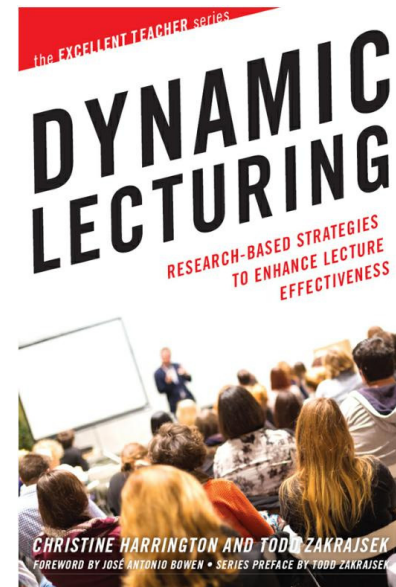
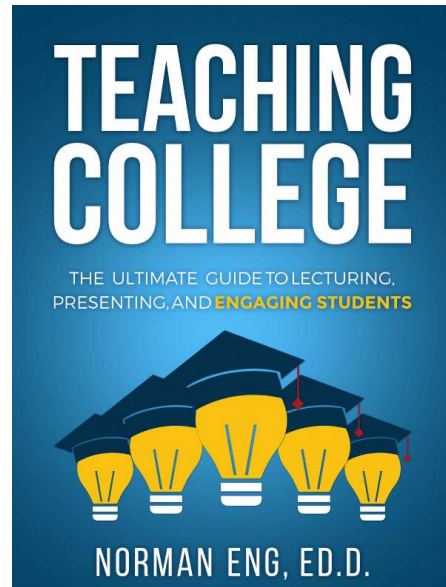


# Teaching guide to interactive and engaging lectures and seminars

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## Ever frustrated in class?

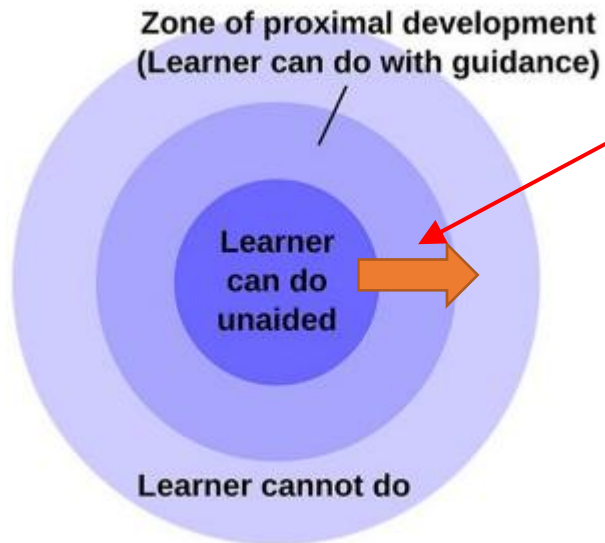
- for lack of attention?
- for students talking?
- for student chatting online?
- for students not learning?

## Problems in many classes

Many students don't or can't follow what the teacher says because

Symptom	Origin or consequence
1. Lectures are too dense or long	People can concentrate for ~20 min
2. Lectures are disconnected from students	The teacher overestimates what the audience knows and underestimates how difficult it is to learn ( <b>expert blind spot or curse of knowledge</b> )
3. Lectures are too much Powerpoint-oriented	Can prevent interaction if abused or misused

## Aims of teaching



Help students proceed across the “zone of proximal development”

- Presence is not enough
- Focus on helping students to learn instead of the material
- Provide and require hands-on experience



Xun Kuang ('ʃʊn 'kwɑ:ŋ), Confucian philosopher also widely known as Xunzi ('ʃʊn 'dzi:)  
c. 310 – c. 235 BC

Tell me and I forget,  
teach me and I remember,  
involve me and I learn.

The Hungarian education system does not really include the “involve me...” part.

## Presence is not enough

### Pros

- Passive learning is better than nothing
- Attendance makes some, otherwise non-attentive students pay attention

### Cons

- Attention and motivation are required for learning
- Nonattentive students distract the attention of others as well

The balance is hotly debated.

Lecture Attendance, Study Time, and Academic Performance: A Panel Data Study

The Journal of Economic Education, Volume 46, 2015 - Issue 3

- significant correlation between performance and lecture attendance, ...
- most of which is lost if adjusted for confounders
- i.e. mostly those student **attend who are hard-workers anyway**

Does Lecture Attendance Matter? A Study of Exam Performance in Medical Neurobiology, The FASEB J.

- No significant relationship between students' lecture attendance and their exam scores

Many approach it subjectively:

- Why should [students] have to attend if they do not think it is [valuable]?
- There were very good reasons for monitoring and promoting high attendance, particularly in the first year
- Compulsory attendance is “contrary to the idea of higher education as a voluntary activity undertaken by adults”

<https://www.timeshighereducation.com/news/should-student-attendance-in-classes-be-compulsory>

## Why do we need a paradigm change?

### 1. Students are exposed to new kind of stimuli



1982



2015

The kind of stimuli bringing up current students,...

... but our lectures are more like this.



Students lose interest.

## Why do we need a paradigm change?

2. Customer-like attitude of students: “You can teach me if you are up for it.”
  3. Many more students enter higher education with needs different from the top 10%.
- 

### What to do?

1. We must not be arrogant: ~~You don't understand? Your fault.~~

We must understand the basic background of students.

2. But we must prepare them for the challenges of their professional career

- team work

new type of challenge

interactive teaching

- boring patients

- boring evaluations

- boring meetings...

old type of challenge

classical and mixed  
teaching methods

- Boring facts and relationships are more important than eye-catching scenes or striking details,
- but present them colorfully, enjoyably.



## Strategic solution plan

### 1. Know your target audience

- Create a profile of your audience (“ideal client profile”)
  - What is your audience like?
  - Why are they here?
  - What do you want them to do, and to achieve in the lecture / course?
  - How might they resist?
  - How can you best reach them?
- Are they “culturally literate”?
- What kind of students are there in the class?
  - Surface learners: want to pass only, memorize instead of understanding
  - Strategic learners: want good grades to get a good job, want procedures to follow
  - Deep learners: grapple with ideas and concepts, want to understand, open for challenges



## Cultural illiteracy

- linguistic
- cultural
- scientific (lack scientific vocabulary)



## Strategic solution plan

### 2. Consider the big picture goal of your STUDENTS

- Why are the students enrolled in the **PROGRAM**?
  - MD students: want to / need to get a deeper understanding to **become a doctor**
  - physiotherapy students: want mostly practical experience with some kind of theoretical background to perform their job

### 3. Figure out the benefit of the course to your STUDENTS

- How can your **COURSE** contribute to the big picture goal?

## Design your lecture / seminar topic

### 1. Narrow in on the main (2-3) areas

- Quality over quantity
- Focus on what is
  - notable
  - fundamental principles
  - difficult to learn
  - often misunderstood



We need an in-depth, learnable source besides the lecture slides.

### 2. Generate a lesson objective or an essential question

- What will the students be able to do after the class?

### 3. Make it relevant to the students

- How can you make the idea (point 2) easier to understand?
- How can the students apply what they learn?

### 4. Provide an underlying idea or (personal) experience

- May be difficult with some of our topics
- Examples (other opening options later):

Topic	Personal experience
Slope	Skiing
Immune system	Comparisons with military, chess, etc.



adjust them to the perceived background

## Two approaches to teaching

### I, We, You

Step 1: I (the teacher) explain

Step 2: We (the class) practice together

Step 3: You (student) will do it

- This is how we teach, but mainly get stuck at step 1
- Sometimes, but not always, facilitates linear and inflexible thinking
  - provides protocols (in steps 1-2) to solve a task (in step 3)
  - instead of teaching principles

### You, You all, We

Step 1: I (teacher) provide a dilemma, individual students try to solve

Step 2: Students work in small groups to refine the solution

Step 3: We (the class) discuss to draw conclusions

- This is how we learn as kids
- Solid, enduring knowledge
- Nonlinear thinking

- Both of them are good
- Many STEM (science, technology, engineering, mathematics) and FOUNDATIONAL courses require the “I, We, You” approach

## Classical lectures vs active learning approaches

Classical: Sage on the stage

Interactive: Guide on the stage

King, 1993

- Some even advocated abandoning lectures completely.
- Lectures can be bad because
  - university teachers are not taught how to lecture
  - there is a different need of current students (higher numbers, more practical knowledge)
- If something is done badly, it is not necessarily wrong by definition.
- In foundational courses student-oriented “sage-on-the stage” lectures are useful
  - on their own
  - to provide the basis for active learning
- A mixture of classical and interactive strategies is best.
- Cognitive engagement vs. active engagement

## How to involve the audience?

### 1. Discussion

- avoid simple “yes or no”, and “who”, “when” and “where” questions

### 2. Debate

- divide the class to two parts with both of them defending a viewpoint

### 3. Small group work

- groups of 3-5 students
- pre-form groups (!?)
- let groups work on their own, then supervise (overhear) before presenting / discussing

### 4. Surveys, quizzes

- if technology permits; online tools available (next slide); Twitter
- you can repeat it before and after discussing

### 5. Role-play

### 6. Demonstration

### 7. Student presentation

- be careful
- boring and potentially misinforming for the class
- teach them how to present

### 8. Case study

- An everyday example to work out
- <http://sciencecases.lib.buffalo.edu/cs/collection/>

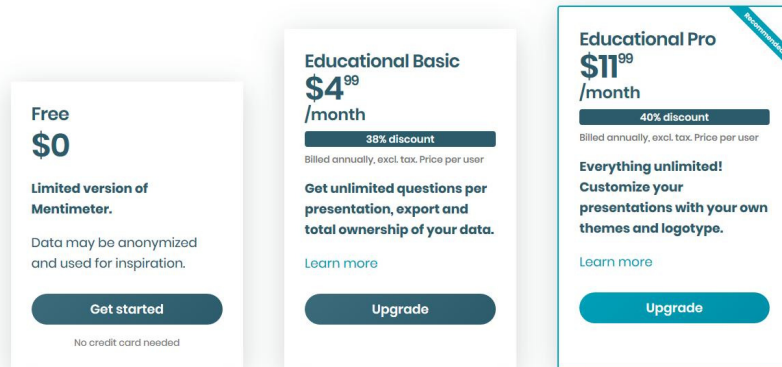
# Simple online polling tools to incorporate quizzes into the lecture / seminar

1. Mentimeter: insertable into PowerPoint

<https://www.mentimeter.com/>

## Mentimeter for Educators

Unlimited poll size for each version



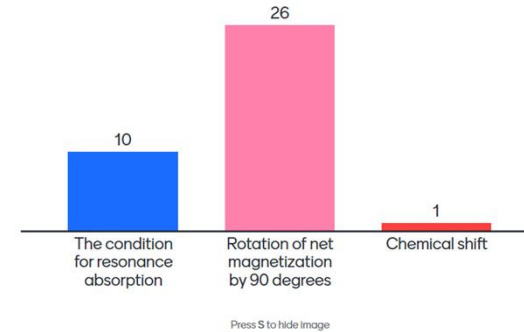
Three pricing plans for Mentimeter for Educators:

- Free \$0 /month**: Limited version of Mentimeter. Data may be anonymized and used for inspiration. **Get started** (No credit card needed).
- Educational Basic \$4<sup>99</sup> /month**: 38% discount. Billed annually, excl. tax. Price per user. Get unlimited questions per presentation, export and total ownership of your data. **Upgrade**.
- Educational Pro \$11<sup>99</sup> /month**: 40% discount. Billed annually, excl. tax. Price per user. Everything unlimited! Customize your presentations with your own themes and logotype. **Upgrade**.

Go to [www.menti.com](http://www.menti.com) and use the code 3660 5097

What does the image below explain?

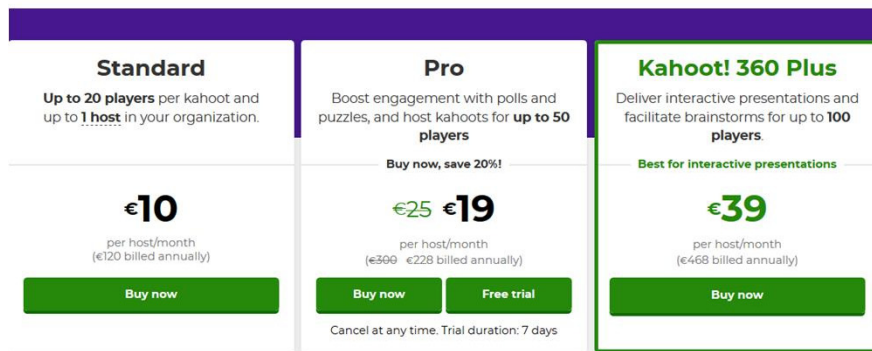
Mentimeter



37

2. Kahoot: standalone, not insertable to PowerPoint

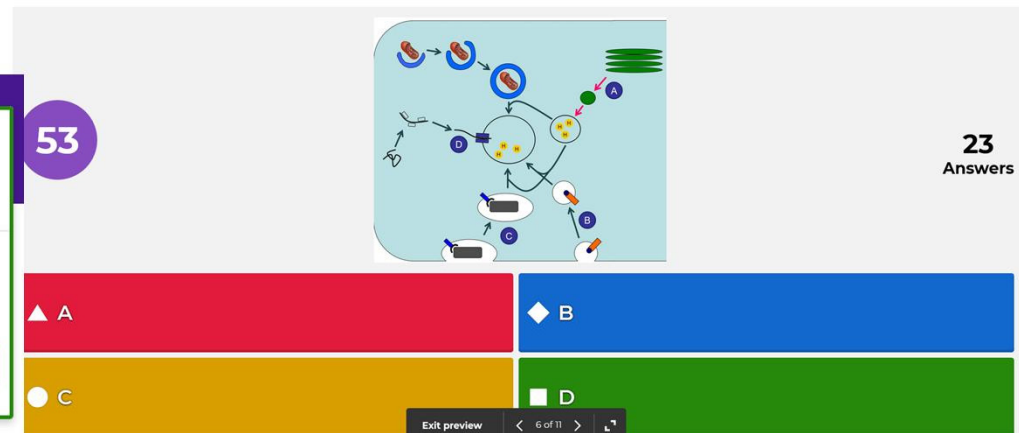
<https://kahoot.com/>



Three pricing plans for Kahoot!:

- Standard**: Up to 20 players per kahoot and up to 1 host in your organization. €10 per host/month (€120 billed annually). **Buy now**.
- Pro**: Boost engagement with polls and puzzles, and host kahoots for up to 50 players. Buy now, save 20%! €25 (€300 billed annually) / €19 (€228 billed annually) per host/month. **Buy now** and **Free trial**. Cancel at any time. Trial duration: 7 days.
- Kahoot! 360 Plus**: Deliver interactive presentations and facilitate brainstorming for up to 100 players. Best for interactive presentations. €39 per host/month (€468 billed annually). **Buy now**.

Which pathway transports hydrolytic enzymes to lysosomes?



Quiz interface showing a diagram of a cell with pathways labeled A, B, C, and D. The diagram illustrates the transport of hydrolytic enzymes to lysosomes. The correct answer is A (Golgi apparatus). The interface shows 53 votes and 23 answers.

Options: A (red), B (blue), C (yellow), D (green).

<https://www.presentation-guru.com/how-to-get-instant-feedback-from-your-audience/>



# Simple online polling tools to incorporate quizzes into the lecture / seminar

## 3. Poll Everywhere: insertable into PowerPoint

<https://www.polleverywhere.com>

Poll size

Higher-Ed Free	Student Pays	Instructor	Institution-wide
Free	\$14 year per student	\$349 semester	Custom
Sign up	Sign up	Sign up	Contact us
40	Limit based on class-size	400	Custom

When poll is active, respond at [PollEv.com/peternagy382](https://www.polleverywhere.com/peternagy382)  
Text **PETERNAGY382** to **+36 70 717 7452** once to join

Visual settings  
Activate  
Show responses  
Lock  
Clear responses  
Full screen

**What kind of education structure would you like to see in our department?**

Don't change anything, it is perfect right now.  
Lectures with some interaction + interactive seminars  
Get rid of lectures  
Get rid of seminars  
I don't want any teaching.

Next  
Previous

Poll Everywhere

## 4. Participoll

<https://www.participoll.com/>

### Individual

1 presenter licence

**\$199** USD/year

+VAT in EU, annually recurring payment

### Team

5 presenter licences

**\$799** USD/year

+VAT in EU, annually recurring payment

### Unlimited

Unlimited presenters

**Ask Us**

Ideal for enterprises and academic institutions

## 5. Ombea

<http://www.ombea.com/>

Price?

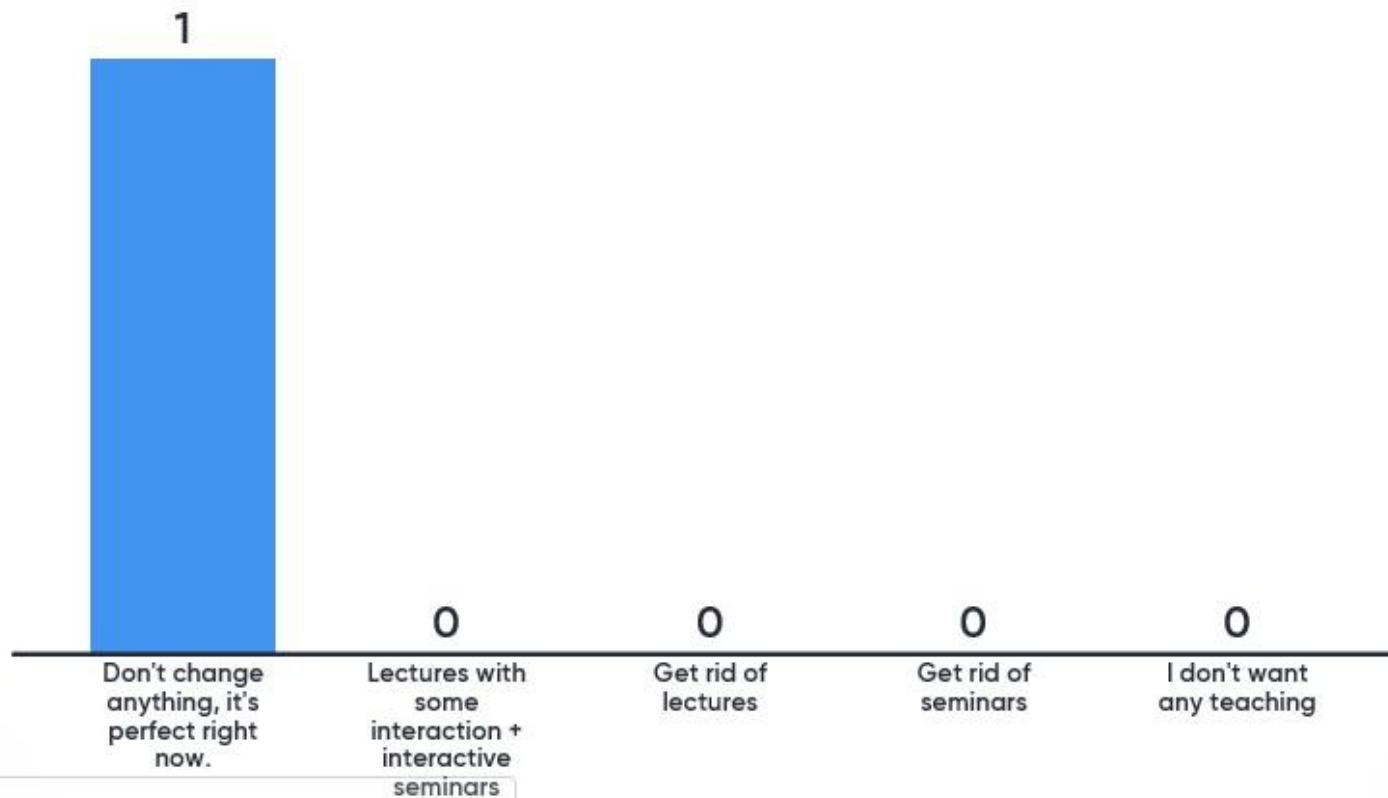
<https://www.presentation-guru.com/how-to-get-instant-feedback-from-your-audience/>

Go to [www.menti.com](http://www.menti.com) and use the code



Mentimeter

# What kind of educational structure would you like to see in our department?



Slide is not active

Activate

1



# To show this poll

1



Install the app from  
[pollev.com/app](https://pollev.com/app)

2

Start the presentation

Still not working? Get help at [pollev.com/app/help](https://pollev.com/app/help)  
or

[Open poll in your web browser](#)



## Importance of engagement

- Three groups were compared (S – study, T – test):
  - SSSS
  - SSST
  - STTT
- Each part lasted for 5 min.
- After the 20-min experiment students were tested twice
  - in 5 min
  - and then again in a week
- Results:

tested in	SSSS	SSST	STTT
5 min	83%	78%	71%
a week	40%	56%	61%

## Class outline: classical lecture with or without interaction

### 1. Opening

- important first impression, the audience decides if you are boring or exciting
- connect with the audience in no more than 1-2 min
- Examples:

Provocative question	Do you think that human cloning is ethically acceptable?
Striking statistic or fact	Do you know that just a couple of decades ago only classical X-ray was available for medical doctors?
Anecdote	This is the X-ray of my broken ankle ...
Quotation	“It is very difficult to predict — especially the future” (Niels Bohr)
Analogy	Our cellular organelles are often likened to factories because ...
Scenario/problem	Let’s say a patient explains to you that ...

## Class outline: classical lecture with or without interaction

### 2. Middle

- don't cram too much information
- divide into parts, interspersed with breaks (less intense or interactive parts)
- summarize each part briefly
- and remember:
  - PEOPLE RETAIN ONLY 20-30% OF WHAT THEY HEAR.
  - PEOPLE'S ATTENTION PEAKS AT 20 MIN AND THEN DECLINES.
- more later...

### 3. End

- Never just end with your last "Result" or "Teaching" slide and then say thank you.
- Connect the end with the beginning
- State your take-home message
  - what the students learned
  - how their attitude to some problems changed based on what we discussed
- Quiz?
- Reflect on some of the questions the student / the lecturer raised

## What to do during the break between the lecture parts?

- Summary
- Relax with a video or with presenting a case
- Quiz testing knowledge
- Poll about what was understandable – not understandable, important – not important, etc.
- Ask students to think the previous part over and write a short summary
- Discussion of a question (continued on the seminars?)



## Class outline: activity-driven interactive class (You, You all, We)

### 1. Opening

- A problem or a case-study presented by the teacher
- Students work individually

### 2. Middle

- In 5-10 min students continue to work in small groups of 4-5 to refine their ideas
- The teacher must facilitate and guide their thinking without foisting his/her ideas on the group

### 3. End

- Each group presents their ideas
- The teacher teaches / preaches at the very end: clarify, summarize, evaluate
- Take home message, etc., like in the previous case

## PowerPoint strategies and timing

### Interaction-intensive approach (“guide on the stage”)

- leave as much as 40-70% of the time for interactions

### Classical approach (“sage on the stage”)

- leave 10-30% for interactions

### General rules for slides

- Be concise, don't write full sentences
- Don't write every detail, the speaker provides the rest (next slide)
- Avoid sub-bullets. (Do you need bulleted lists at all?)
- Animate the slides
- Leave plenty of empty space
- Do you need words? Picture or video better (?)
- 10-20-30 rule: max 10 slides, max 20 min, font size no less than 30 pt (?)

## PowerPoint strategies

### Race in U.S. Public Schools

Minority students will become the **majority** (projected 2025 numbers):

- White: 46%
- Black: 15%
- Hispanic: 29%
- Asian/PI: 6%
- Others: 5%




Not bad

### Race in U.S. Public Schools

Minority students will become the **majority**:

White	46%
Black	15%
Hispanic	29%
Asian/PI	6%
Others	5%



Even better



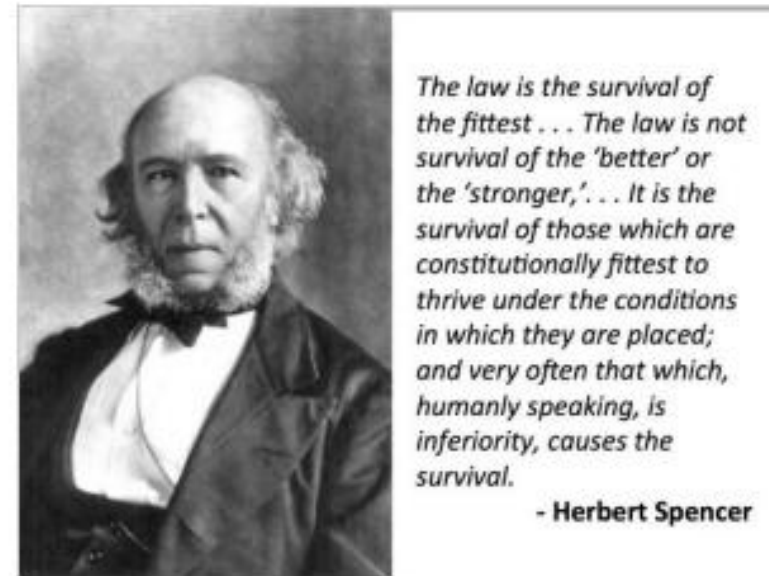
By 2025:  
**55%**

The best (I don't agree)

## PowerPoint strategies

**Herbert Spencer**  
(1820-1903)

- Spencer's ideas about education influenced by Darwin's *Theory of Evolution*: Survival of the fittest.
- Wanted schools to compete against each other.
- Believed people in an industrialized society needed a utilitarian education.
- Introduced rationale for curriculum development based on promoting health, social relationships, and economic productivity.



- too much to read (?)
- but if slides are available for download (?)
- two different things

- better because less (factual detail) is more (but consider the remark on the left)



slide set is a standalone source

slide set only supports what the teacher says

## Structure of a PowerPoint slide set

### 1. Opening

1. Connect with the students, raise interest in 1-2 min (provocative question, striking fact, anecdote, quotation, analogy, problem)

- Do you know that a single human cell contains  $\sim 10^5$  different proteins? How can a cell produce this many from  $\sim 20,000$  genes?

2. State the objective

- You will learn (what) by (how) so that (benefit)
- You will learn how proteins are modified after their synthesis in order to understand and appreciate their immense variety.

3. How is the outcome of the class relevant to students?

- Why is it meaningful? How will students apply it? Make it more understandable for them.
- These processes, called post-translational modifications contribute to cancer development and to even genetically identical individuals responding differently to drugs.

## Structure of a PowerPoint slide set

### 2. Middle

- connect to
  - previous knowledge, if possible, at the beginning and throughout
  - to the interest of the students several times (to make it relevant)
- not too dense, not too long
- divide into 15-20 min sections separated by easier/interactive parts

• each part: beginning, middle and end

- 
- identify subtopic
  - you may ask a question
  - elaborate the subtopic
  - summarize
  - interactive part (quiz, survey, discussion)

- mark the most important ideas
- don't read from the slide continuously
- animate the slides
- A picture is worth a thousand words

## Structure of a PowerPoint slide set

### 3. End

- **Connect the end with the beginning**
- State your **take-home message**
  - what the students learned
  - how their attitude to some problems changed based on what we discussed
- Quiz?
- Reflect on some of the questions the student / the lecturer raised
- You learned different post-translational modifications.
- You should appreciate how they influence cellular phenotype.
- Why Linda responded differently to the treatment from how Susan did?



## Optimizing discussions

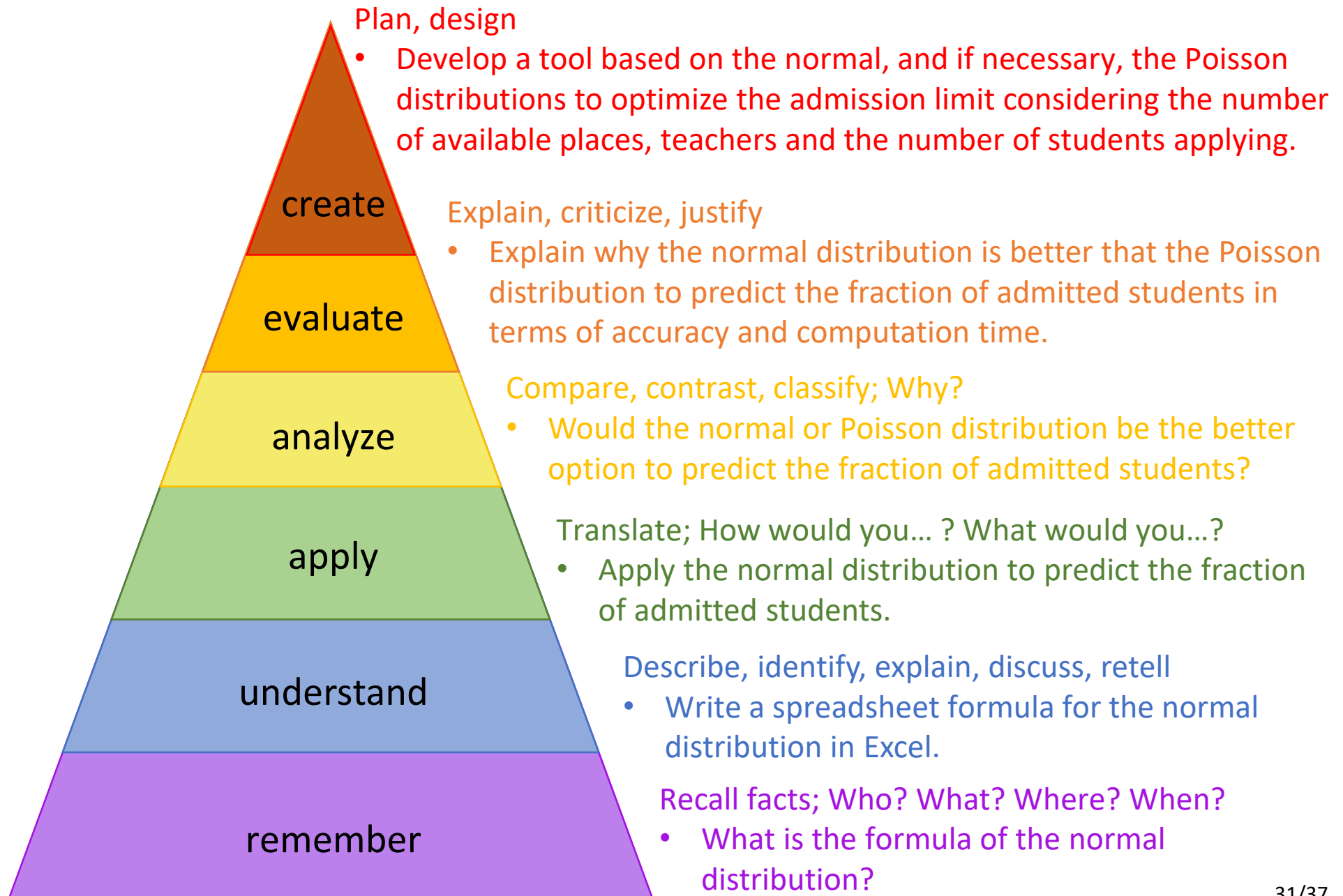
“What did you do in the class yesterday?”

“Nothing, we just spent the whole class talking.”

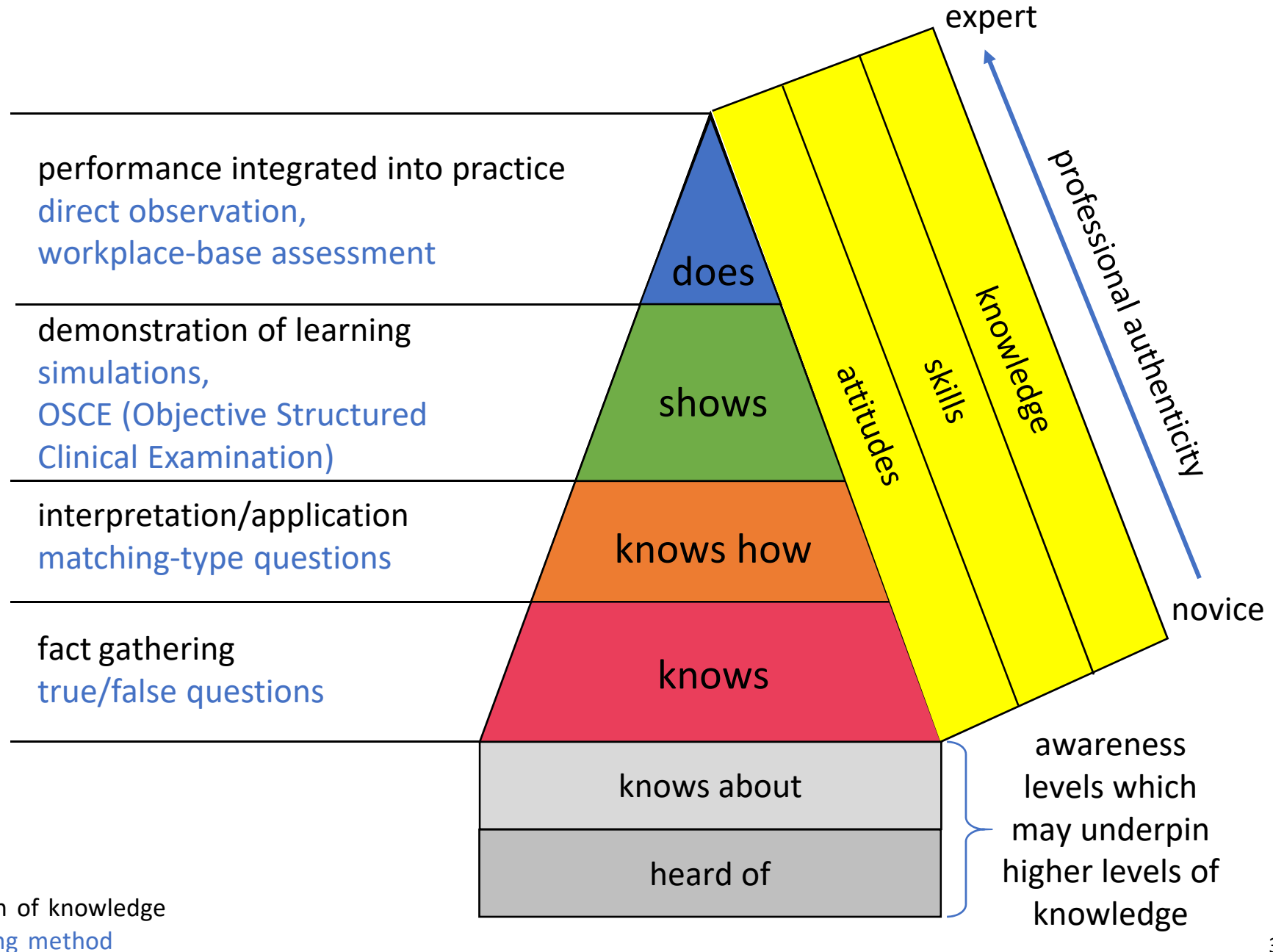
### To prevent this

- Post the discussion questions visibly
- Request students to come to class with a question
- Arrange seats favoring discussions (semi-circle)
- Give sufficient time (up to a couple of minutes) for the students to think
- Vary questions (factual knowledge, opinion, non-linear thinking)
- Challenge student’s responses
- Reflect on student’s responses, clear up misconceptions without interfering too much
- Don’t allow the discussion to go off-topic
- Make sure everybody participates

# Objectives and depths of learning in the cognitive domain: Bloom's taxonomy

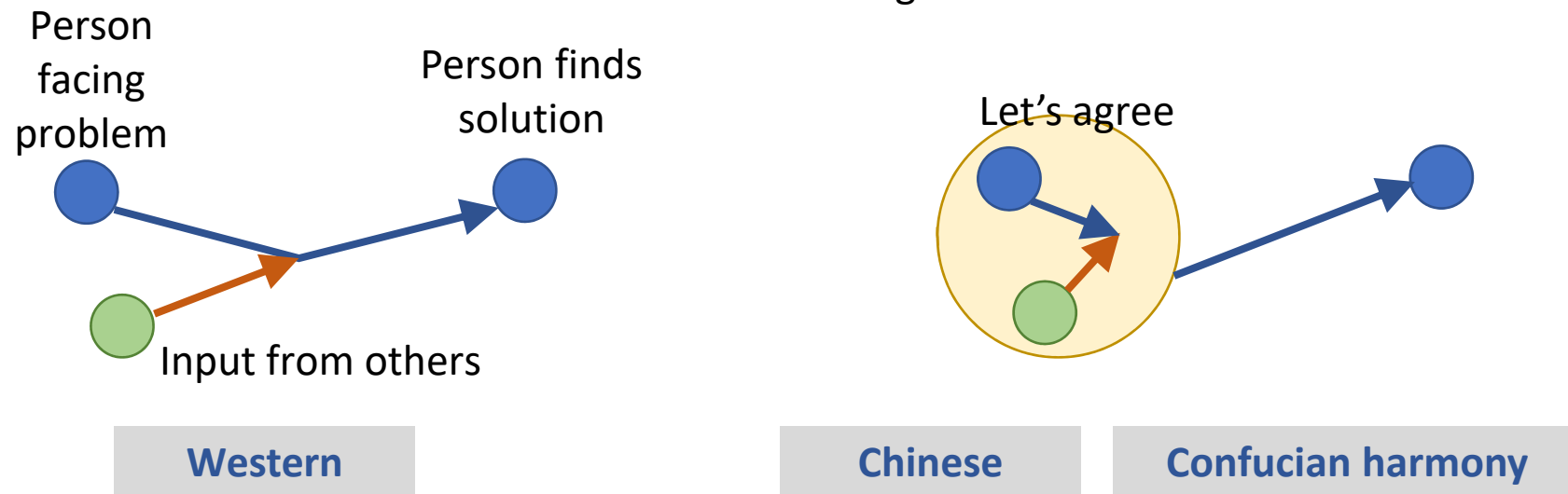


# Levels of learning: Miller's pyramid



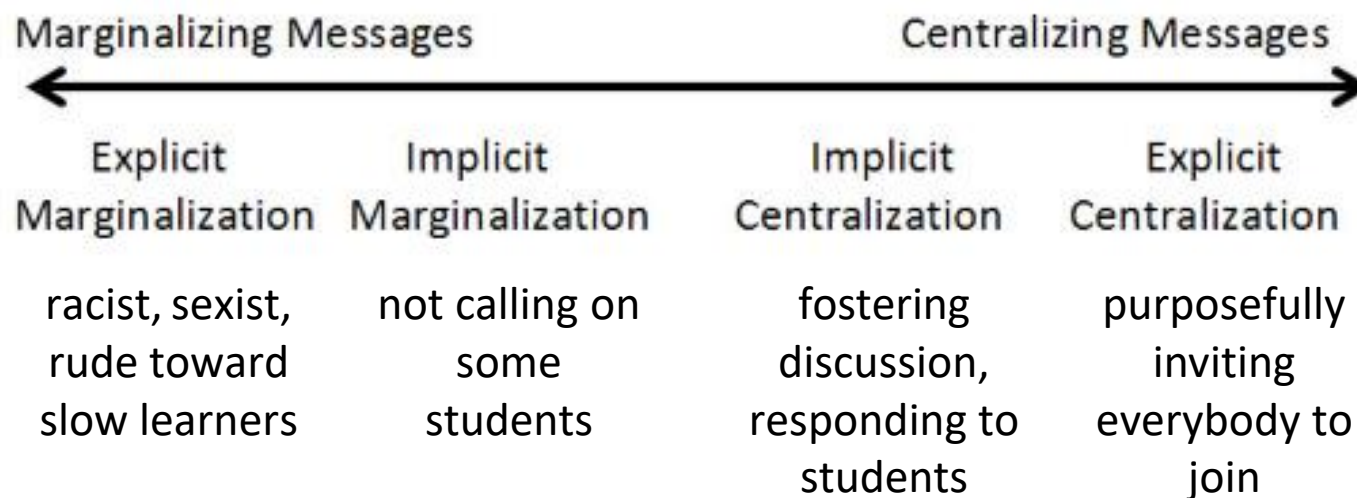
## Help students succeed

- Create a safe and supportive learning environment
  - students are worried about the teacher
  - first impression at the very beginning of class
  - chat with students
  - team work
  - mutual respect (student → teacher, teacher → student, student → student)
  - be aware of national differences in attitude
    - Some Islamic male students don't respect women
    - Chinese – Western misunderstanding

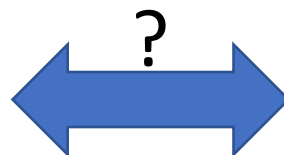


## Help students succeed

- Create a safe and supportive learning environment



- Be enthusiastic, funny, and **smile**



- Remember students' names

## Help students succeed

- Cultivate a growth mindset



- Emphasize that learning is not achieved without efforts
- “Your answer is not yet good, how could you proceed if you consider that ...”
- “Everybody can pass biophysics with a good grade”

## Help students succeed

- Address problems early
  - Students talking, Facebook-ing, being late
  - misbehavior must have consequences

### Carnegie Mellon University

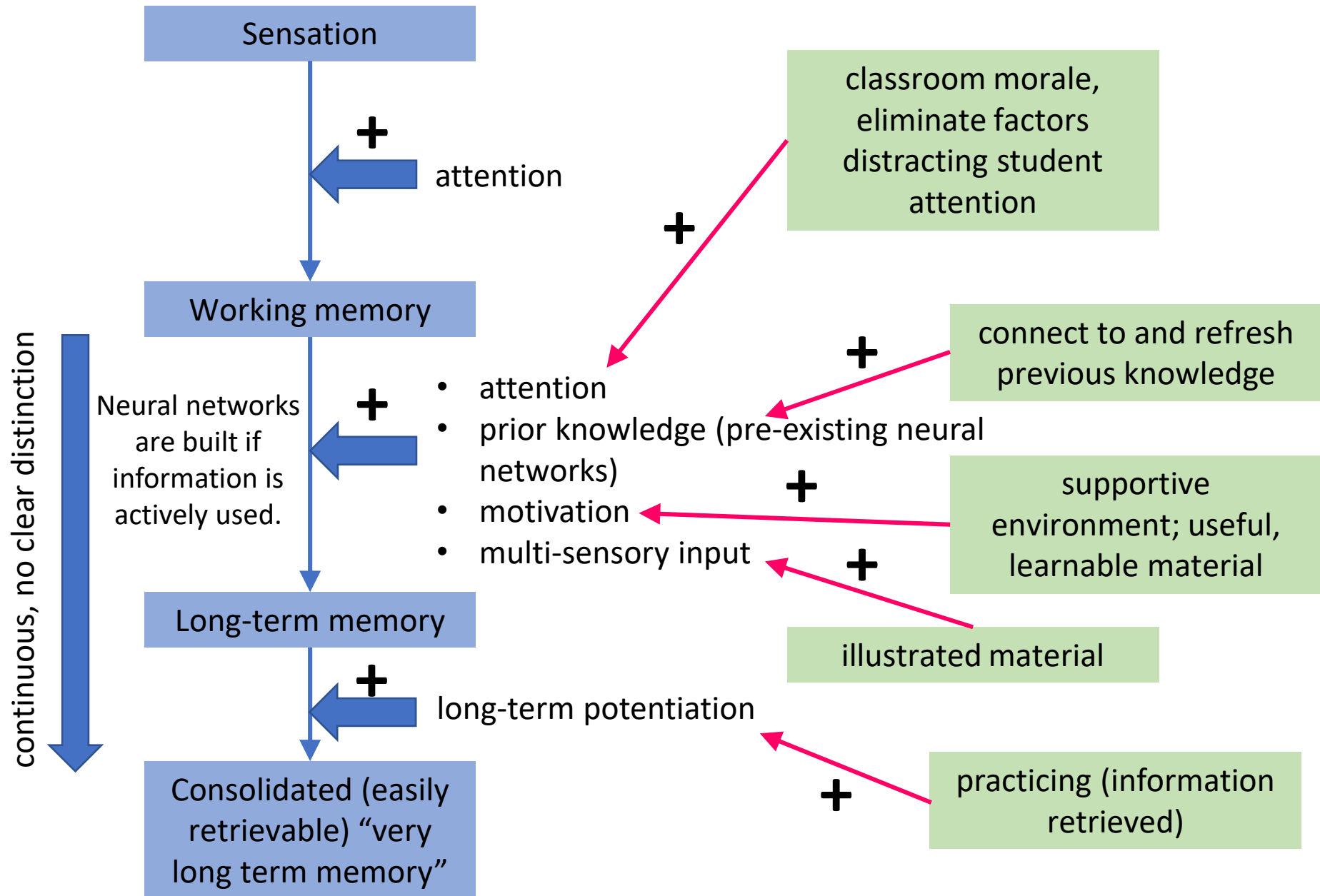
<https://www.cmu.edu/teaching/solveproblem/step1-problem/index.html>

- Articulate your expectations
- Provide feedback (e.g. after presentations) regarding strengths and weaknesses
- **Activate / check prior knowledge (quiz, questions, discussion, preaching)**
  - to facilitate relating new info to old
  - to build on previous knowledge
  - so that you know what to expect





# Physiological / psychological background of how to help students learn



## My suggestion

### 1. Lecture

- “I, We, You” approach achieving only step 1 (“I”)
  - The teacher preaches and explains the notable, most (but not all) of the material
  - because we (will) have slide descriptions  
**(Let’s liberate the lectures.)**

### 2. Seminar

- mixture of “I, We, You” and “You, You all, We” approaches
- engage students
- make them work at home
  - essay
  - presentation (provide exemplars for good and bad presentations)

1. establish a different lecturing / teaching culture (?)

- not focused on teaching facts
- rather on principles, deliberations...

2. always connect with the students

- fewer classes to ease the burden on teachers and students?
- same teacher for the group for the whole semester?