

EPFL

ENG-629

Presenting and Lecturing in Engineering

■ École
polytechnique
fédérale
de Lausanne

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2025



EPFL Schedule Day 2 2025

MORNING

9:00 Defining learning, evidence of learning

10:30 *break*

10:45 Your Day 2 lessons

12:00 Reflective activity

12:15 *lunch break*

AFTERNOON

13.15 Teaching with questions
Active learning

14.30 *break*

14.45 Classroom management

15.45 Video analysis

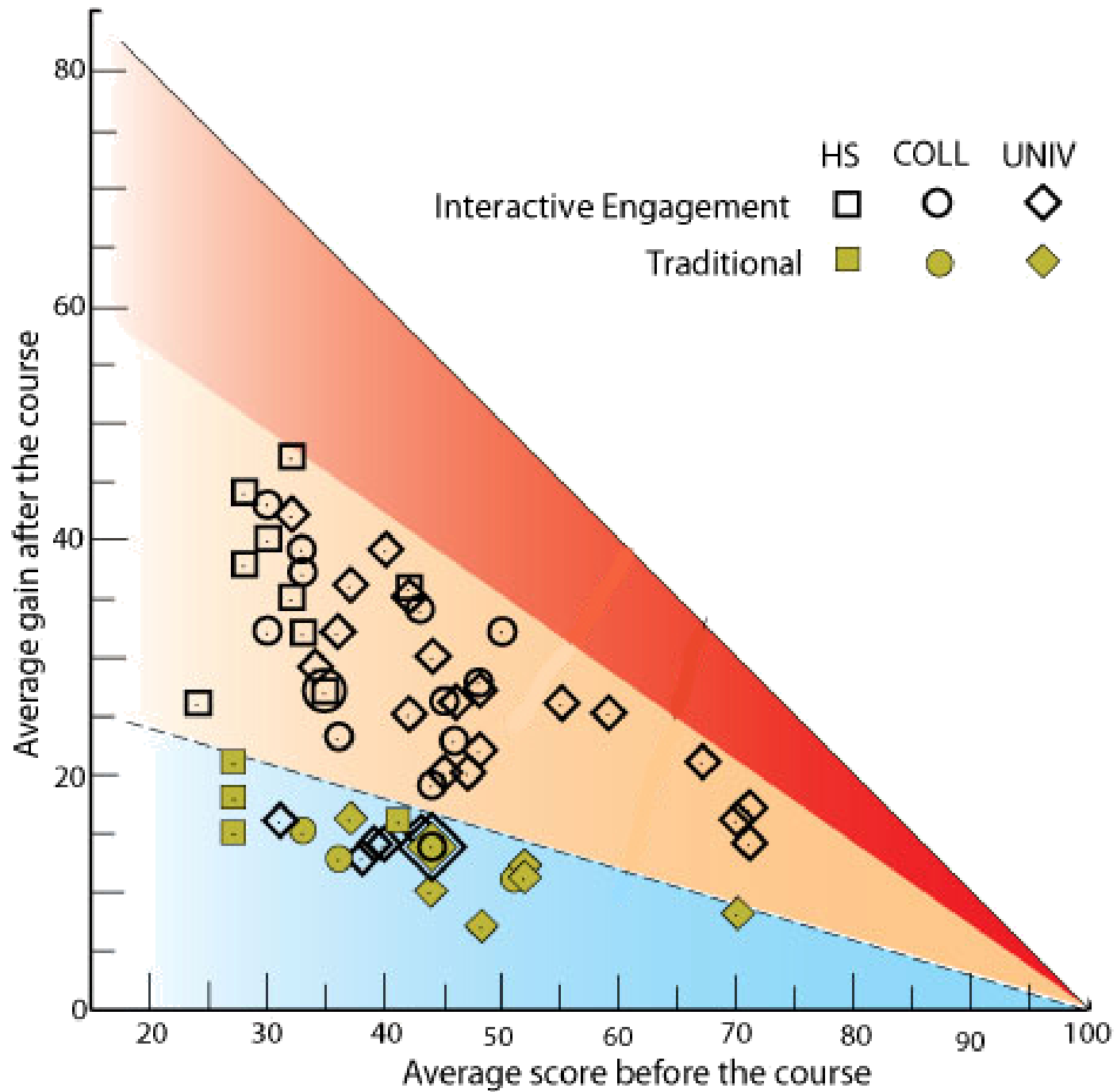
16.45 Conclusion, prep for Day 3
Reflective activity

****hand in your Daily Reflection*

Data: Introductory Physics courses

- Halloun-Hestenes Mechanics Diagnostic Test (1985)
 - Pre- and post tests
 - Evaluate conceptual knowledge gain

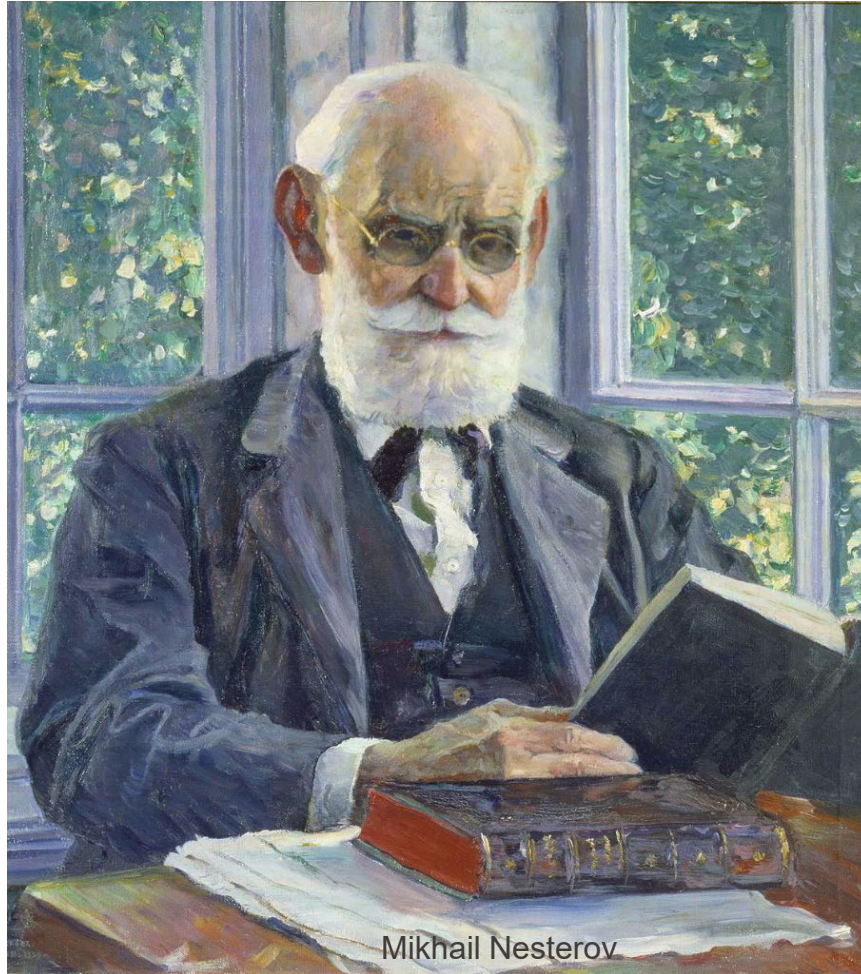
- Hake's study
 - 6542 students
 - 14 courses that used **traditional** methods (T)
 - 48 courses that used **interactive engagement** methods (IE)



Defining learning

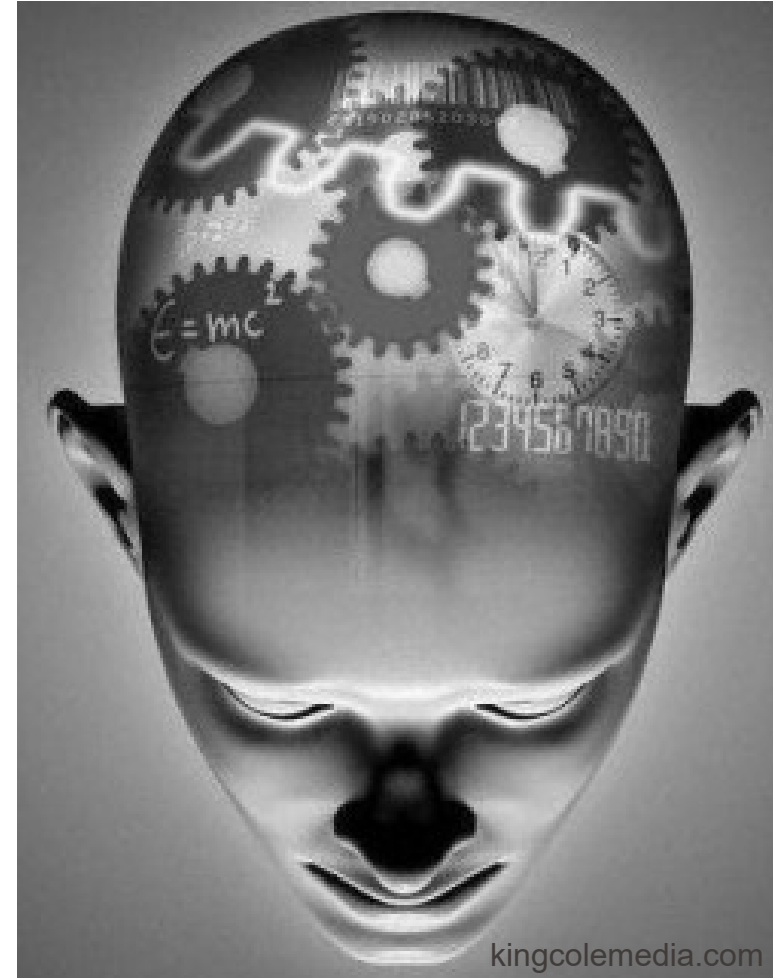


Learning is a change in the observable behaviour of the learner.



Behaviorism

Learning is a complex mental process involving the manipulation of symbols



Cognitivism

EPFL

Learning is an active, constructive process performed by the learner *and reinforced through interactions with others and the resulting cognitive conflict.*

socio-constructivism

constructivism



Piaget et Vygotsky



Active Learning: Why and How



Learning Objectives

At the end of this presentation, you should be able to:

- Explain the **affordances of active learning**.
- Compare various strategies to **increase active learning** in your classroom
- Facilitate **interactivity using questions**.



Jigsaw: Freeman et al. 2014 PNAS article



- You will start in a group with other people who have the **same letter** as you.
- Read the article and answer the questions corresponding to your group. A : intro B: results C + D: discussion
- Now form a group with people who have the **same colour** as you.
- Discuss your answers from your first discussion groups. 3

Group task

 ~ 20 mins

Group task

 ~ 20 mins

Plenum discussion

- How should university teachers respond to this study?



Teaching without telling

Using questions

Tormey & Isaac. (2022). *Facilitating Experiential Learning in Higher Education Teaching and Supervising in Labs, Fieldwork, Studios and Projects*. Routledge.

<https://doi.org/10.4324/9781003107606>

There will (hopefully) be (a lot of) questions



Context: You expect students to actively engage with your class – and to ask a lot of questions!

This can generate anxiety and frustration.

Goal: **Create a climate that encourages students** to feel it is ok to ask questions, while at the same time not immediately answering the question for them.

Micro-skill: **Welcome the question (do not answer - yet).**

Task: **Welcome the question (about ducks). Don't answer it!**

Understand where the question comes from

Context: *The Curse of Knowledge...* Experts (you) often don't remember what novices (them) don't understand.

Goal: Get the student to think, understand their question better, give yourself time to figure out a response.

Micro-skill: Ask for more information.

Task: Welcome the question (about ducks). Don't answer it!

Respond with a question that gets the student to articulate what they do and don't understand.

Let the students take the cognitive load

Context: We learn best when cognitively engaged.

Goal: Get the students to learn better by having **them do the thinking** (instead of you telling them).

Micro-skill: **Ask a question/give a thinking task.**

Task: Welcome the question (about ducks). Don't answer it!

Respond with a question that gets the student to articulate what they do and don't understand.

Ask a question/give a thinking task.

When responding to student questions

- Be **welcoming** (i.e. it encourages the student to keep asking questions)
- Ask a **genuine, open-ended question** to the student (not rhetorical)
- Use another question to point the student in the right direction while still **requiring them to think for themselves**
- Formulate questions that **help students with more than just this question** (i.e. developing process/skills for future tasks)



Active Learning: Why and How



Active Learning

Students are engaged in actively constructing their learning.

Many strategies

- Jigsaw
- Think-pair-share
- Discussions
- Brainstorming

▪ Some considerations for inclusion

- Non-native speakers or verbal disabilities
- Social anxiety
- Educational norms

Active Learning: The pause

- After every chunk of instruction – break for 2 mins.
- Allow students to summarise, make notes.
- Promote encoding



Active Learning: Quescussion

A question-based discussion:

- All interventions must be questions.
- Only one question at a time.

How much energy is required to boil a pot of water?

Debrief by

- Appreciation for all responses
- Highlight relevant thinking and clear up misconceptions

Active Learning: Asking questions

Does anyone
have any questions?

Why, how, contrast, predict, explain

**“Compare classical Newtonian
mechanics with relativistic mechanics.”**

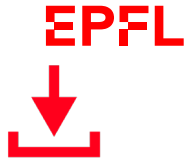
What, who, where, when, true/false

“What do Newton’s laws of motion say?”

Active Learning: Minute paper

- Students write their responses to a specific question.

Starting from one of your learning objective for today's lesson, construct one precise question to test that learning objective.



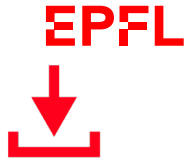
Methodology for interactive strategies

- Prepare questions appropriate for the learning objective and the teaching strategy
- Foster a climate that encourages participation
- Ask ONE clear, concise question at a time
- Wait

Still waiting?

- Rephrase your question.
- Do they have all the information?
- Think-pair-share

- Is the classroom environment conducive to their participation?



Encouraging responses

- Be positive
- Be specific, reiterate
- Build on the response
- Ask probing questions:
 - “How did you arrive at that answer?”
 - Clarify: “Could you rephrase that statement?”
 - Increase awareness: “What are you assuming?”
- Invite others to comment on the response.
- Extract important points and clear up confusion.



Active Learning: Buzz groups

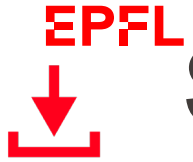


- Break into 4 teams
- By team, respond to the following question
- On the right side of the room:
How to encourage « timid » students to participate more?
- Left side:
How to contain a student who always has a response?



Active Learning: Rally Robin

- One question at a time
- Each group takes turns to give a suggestion



Student participation is not a spontaneous phenomena...

- **Structure participation!**
- Explicitly share your expectations
- Formulate learning objectives
- Chose an appropriate strategy
- Prepare clear instructions (time, etc.)
- Consider how to provide feedback



Classroom Management: Why and How

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4th March 2022

Learning to manage your relationship with a class is important for STEM teaching

- relationships with empathy and warmth showed a moderate to strong correlation with achievement in mathematics ($r=.36$; Cornelius-White 2007).
- moderate impacts on cognitive learning ($r=.17$; Wit et al. 2004)
- affect student attendance and absenteeism (Rocca, 2004)
- classroom incivilities (Boice, 1996)

Safety Warmth Authority

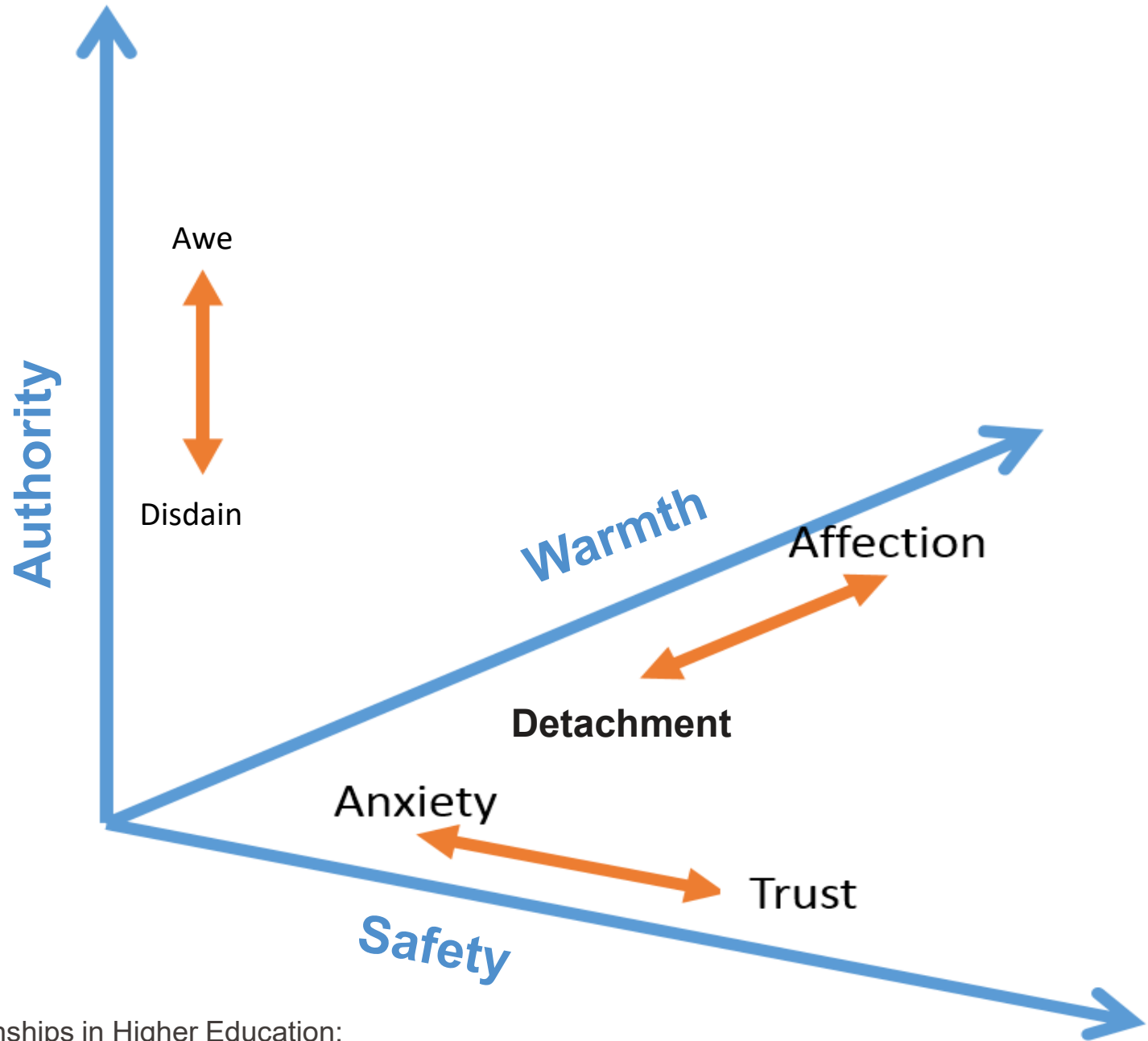




Table X.1 activity from « THEORIZING THE EMOTIONAL QUALITY OF TEACHING AND LEARNING RELATIONSHIPS IN STEM FACULTY DEVELOPMENT » TORMEY, LE DUC & ISAAC (2022)

- Complete the activity based on the 3-dimensional model of classroom relationships.  ~ 8 mins
- Compare your responses with a neighbour to identify the actions which are most and least constructive to building classroom relationships.
- What pairs or combinations of actions can be used to influence student behaviour while maintain constructive relationships?  ~ 12 mins

Class management is a skill that develops and improves over time

Lack of confidence leads novice teachers to correct rather than to prevent incivilities (Reupert, 2010).

When surveying 397 Geography instructors, results showed that **hostile** behaviors were rare but significantly directed towards women, ethnic minorities and foreign instructors (Alberts, et al, 2010).



Heike C. Alberts , Helen D. Hazen & Rebecca B. Theobald (2010) Classroom Incivilities: The Challenge of Interactions between College Students and Instructors in the US, *Journal of Geography in Higher Education*, 34:3, 439-462.

Reupert, A., and Woodcock, S. (2010). Success and near Misses: Pre-Service Teachers' Use, Confidence and Success in Various Classroom Management Strategies. *Teaching and Teacher Education* 26(6): 1261-68

Reactive Classroom Management

- Act Early
 - Even preventative measures
- Respond in graduated way (minimise disruption)
 - Eye contact
 - Stand near
 - Silence
 - Speak
- Target Response

Do what's needed
for learning,
not for your ego