Panel Session: Moderator: Igor Ivkovic
David Wang, Electrical and Computer Engineering, University of Waterloo
Maud Gorbet, Systems and Biomedical Engineering, University of Waterloo
Jen Boger, Systems Design Engineering, University of Waterloo and Research Institute for Aging

Flipped Classrooms: Perspectives on fostering student's curiosity and interest in research

Summary

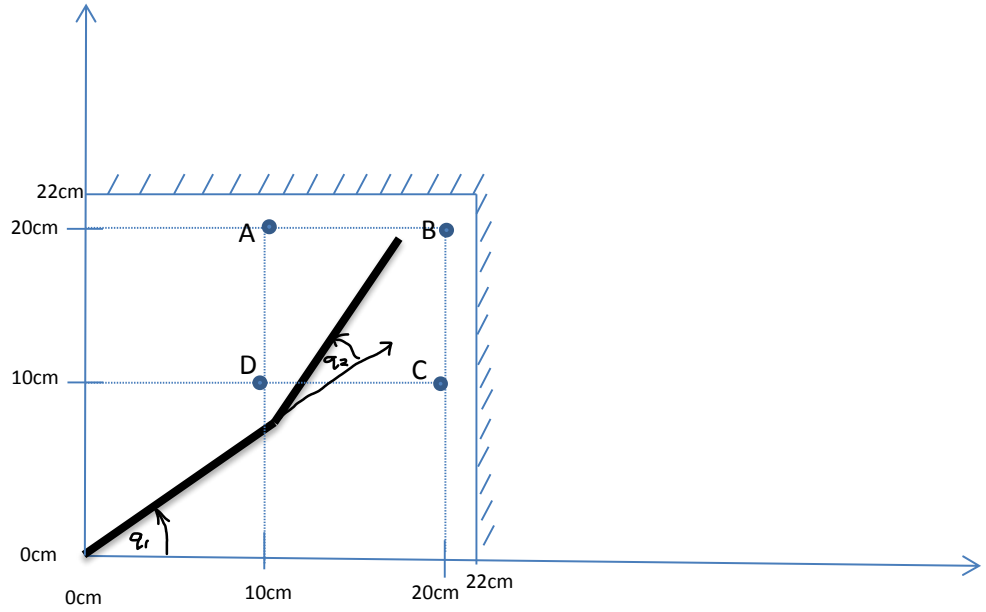
- David Wang
  - Flipped Classroom with online videos (technical elective)
- Maud Gorbet
  - Flipped Classroom in a core second year science/eng. course
- Jen Boger
  - Blended classroom in a 3rd year ethics core course

Dave Wang: Summary

- Introduction
- The Traditional Method
- Flipping the Classroom
- Creating the Online Videos
- Creating the Classroom activities
- Results

Dave Wang: The Traditional Method

- Partial powerpoints
- Lectures filled in the blanks
- Attendance issues
- Poor capstone project results



Dave Wang: Flipping the Classroom

- Decided to fully flip
- All lectures online (25)
- Form of lectures the same (ie student fill in notes)
- Just over 30 minutes of video on average
- Class time was spent on exercises on Matlab with professor and TAs in attendance
- Every class had a quiz or a deliverable (Matlab script) worth 20 marks total
- Capstone project worth 30% (control of a robot)

Dave Wang: Creating the Online Videos

- Webcam and Apowersoft Screen Recorder Pro with Microsoft Surface Pro and Yeti Blue Mic
- Need to "point" to material
- Need overenthusiasm
- Used www.piazza.com for any questions. Average response time of 55 minutes

Dave Wang: Creating the Online Videos

- Example of online video

Dave Wang: Creating the Classroom Activity

- 1 TA for every 10 students
- Groups of 2 (randomly assigned)
- Matlab exercises. Two levels of difficulty. Deliverable is the easier problem.
- They could apply techniques to capstone project if they finished early

Dave Wang: Results

- Almost perfect attendance for an 8:30am lecture
- Found out about student abilities quickly
  - Struggles with some threshold concepts such as linearization
  - Only some of the students familiar with Matlab
- Finished in 10 weeks rather than 12 and completed more material

Dave Wang: Results

- Last year, there were 22 groups (average 3 members each).
  - 10 groups completed the project specifications without noise (45%)
  - 0 groups completed the project with noise included (0%)
- This year, there were 18 groups (average 2 members each).
  - 11 groups completed the project specifications without noise (61%)
  - 16 groups completed the project specifications when the time at the target points was relaxed (89%)
  - 9 groups completed the project with noise included (50%)

Dave Wang: Results

- Students surveyed at end of course
  - 63% of class agreed or strongly agreed that they liked the online videos
  - 83% of class felt the length of the videos was about right
  - 93% of class felt the capstone project helped their understanding
  - 88% of class felt confident about ability to tackle new problems
  - 71% felt the flipped class helped learning more than traditional
  - 61% felt flipped was more engaging and 20% felt it was less engaging

Dave Wang: Results

- Attendance up
- Engagement up
- Ability to actually use software and to do a legitimate design is up significantly
- Feedback to students greatly improved
- Workload about right
- Video, projects and deliverables about right

David Wang

- Questions?

Maud Gorbet: Student feedback on 2nd year core course (materials science)

- Loved the course but it would be nice to have more examples, hands on experience
- I really like the real world examples. Need more applications
- More applied problems!!
- Should have labs

***ME**: not enough time to answer the interesting questions*

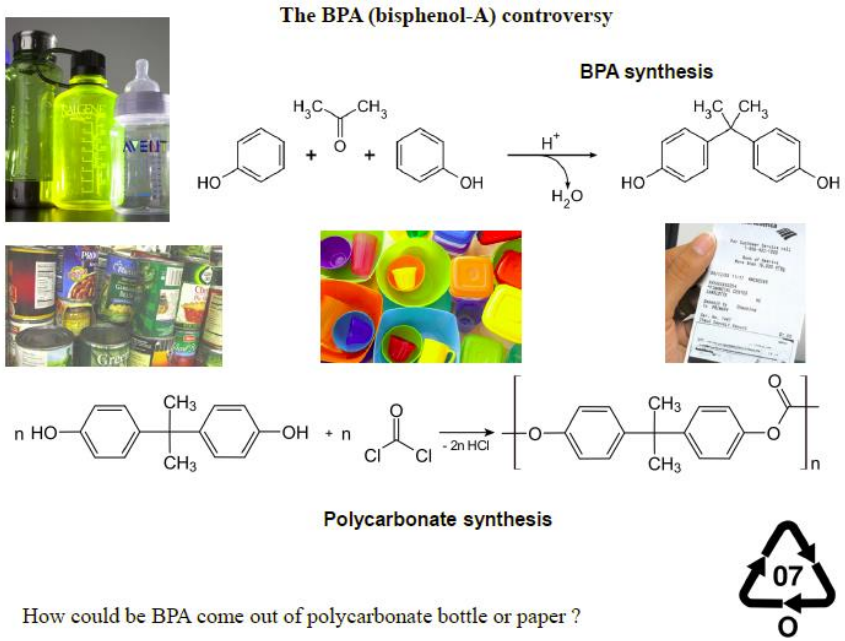
Maud Gorbet: Flipping the Classroom in materials science

- Decided to fully flip
- Lecture slides online with additional textbook chapter reading
- Online short quiz to complete prior class
- Class time dedicated to different learning activities

Maud Gorbet: In class learning activities to foster curiosity and inquiry

Class time = working session, apply concepts , experience, ask questions

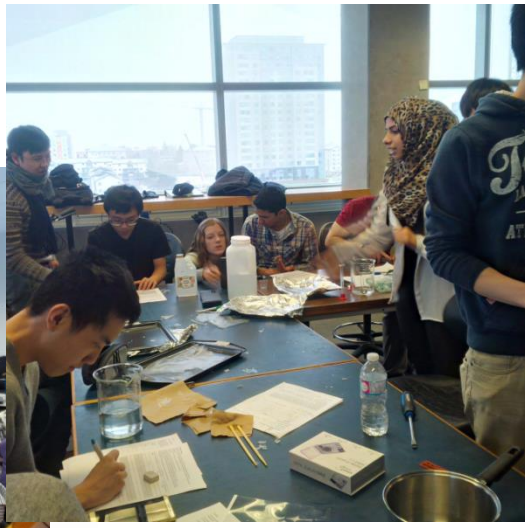
- Draw connections between concepts
- Small practice exercises
- Apply concepts to more complex problems



Maud Gorbet: In class "BIG" learning activities to foster exploration

The case for on site testing of hardness and toughness for icebreaker vessels

eStem



MEMO

TO: Director of Materials Engineering Department, Boston Scientific
FR: Research Group 1; [redacted]
RE: Biocompatibility Studies Funding: Stent Material Selection for Continued Research
DA: March 30, 2017

Recommended Material Selection for Further Research for Commercial Stent Use

While looking at stent requirements, our group found that there may be a more advantageous material then the ones currently being used. The alloy composition we recommend is a 35% Pt-stainless steel

Maud Gorbet: Mini-project to foster inquiry

A Chemical Analysis of Climbing Chalk

Effects of Expanded Thermoplastic Polyurethane (E-TPU) in Adidas Boost Sneakers

A Look Into Spider Silk and its Application in Body Armour

Cymbal alloys

800 to 1200 words

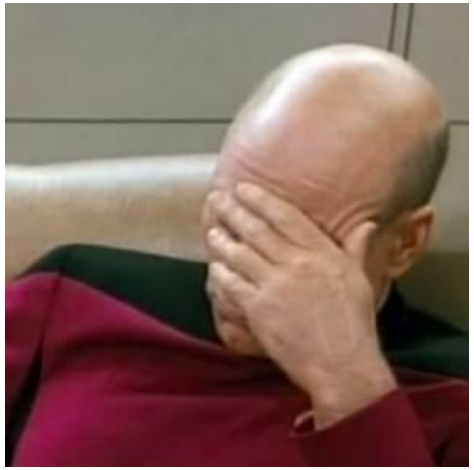
Average of 17 references per paper!

Success of the flipped classroom

- Students embrace and engage in all the opportunities to explore, question, apply

- BUT….

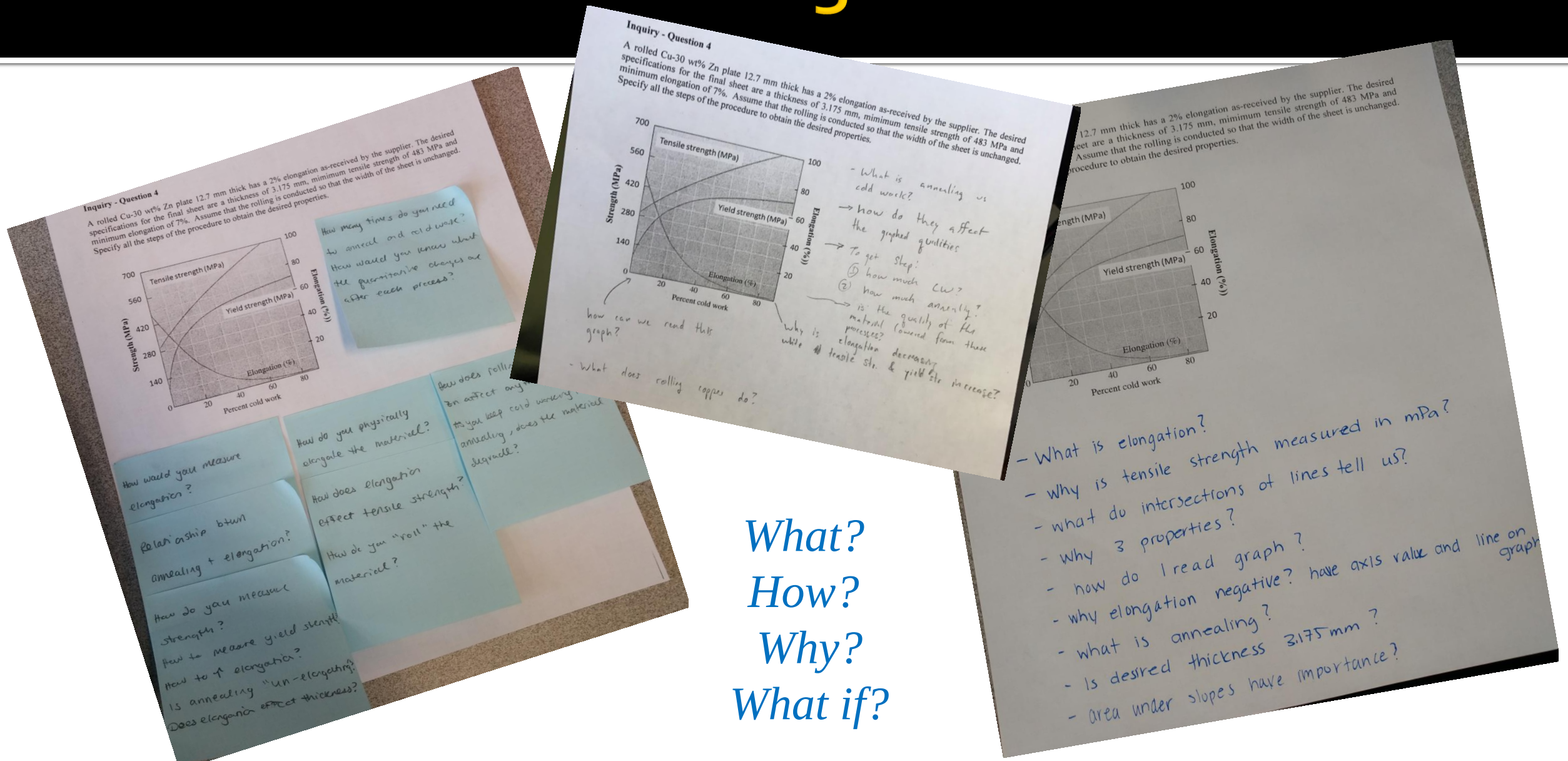
Maud Gorbet: What happens in a flipped classroom when students are not curious



- Change problem format, adapt flipped classroom

- Some are genuinely not interested but most of them
  - Are afraid of asking questions
  - Don’t like asking questions (introvert)
  - Don’t know how to ask questions

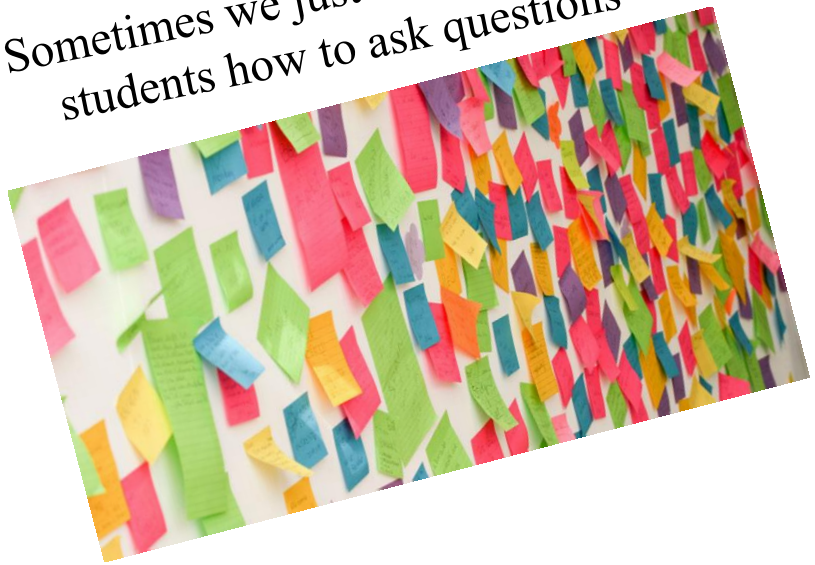
Maud Gorbet: Teaching… to be curious



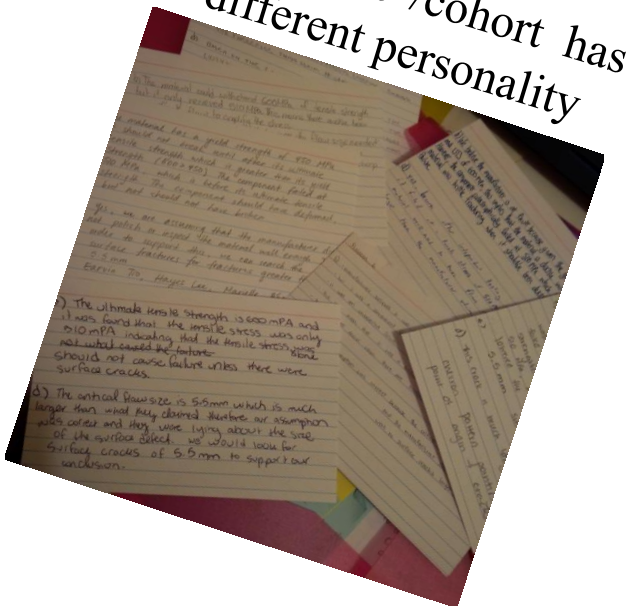
What?
How?
Why?
What if?

Maud Gorbet:
Inquiry and the flipped classroom: it does work…

Sometimes we just need to remind students how to ask questions



Every "class"/cohort has a different personality



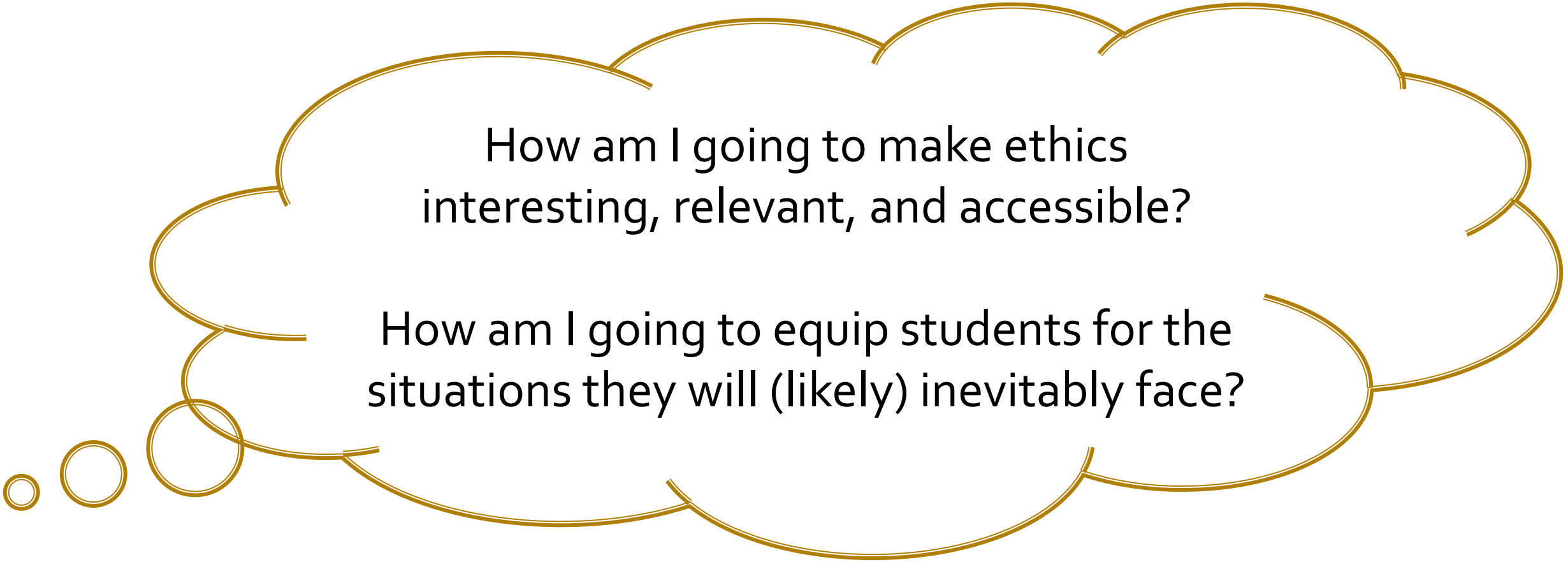
- Even the students who didn't like the flipped classroom ended up engaging enthusiastically in the case studies.
- Our classrooms are not designed for flipped classroom
- TAs are not used to the flipped classroom.

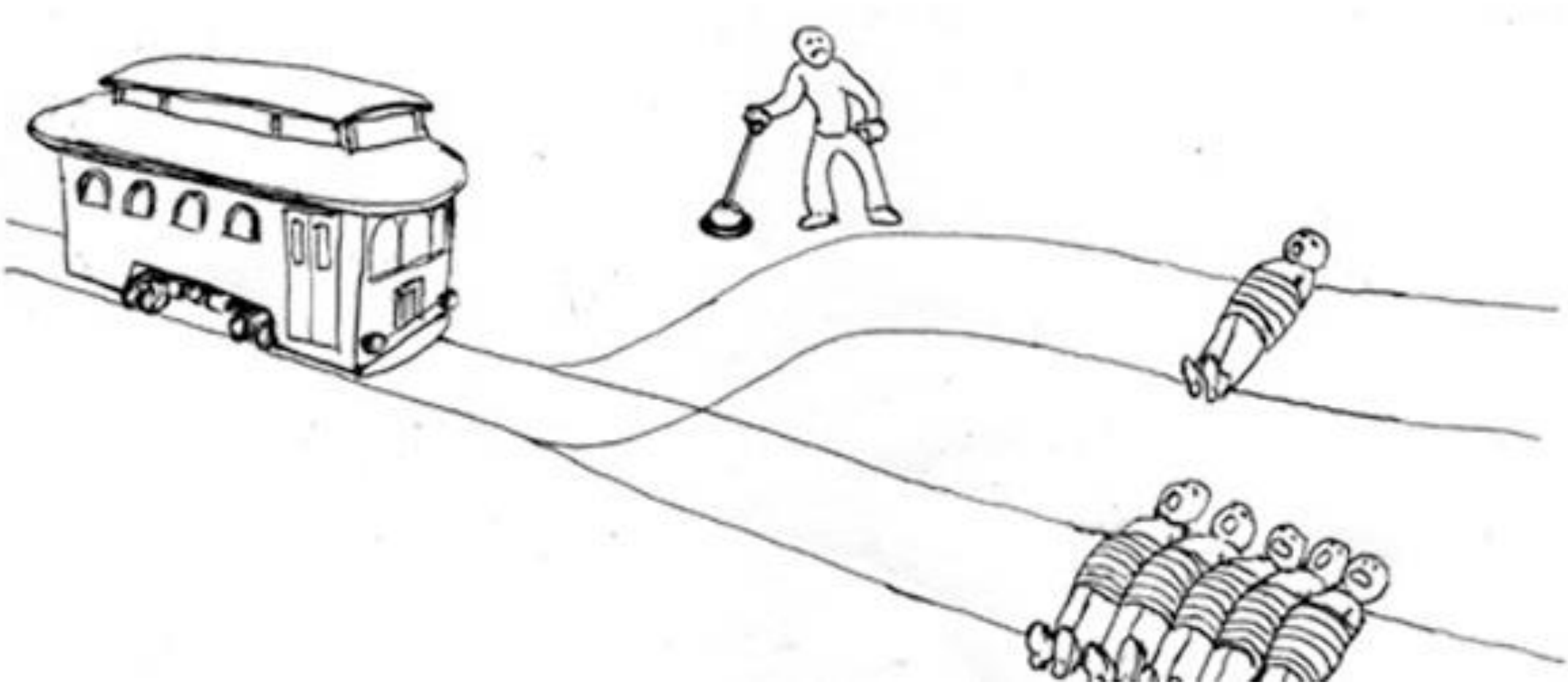
Maud Gorbet

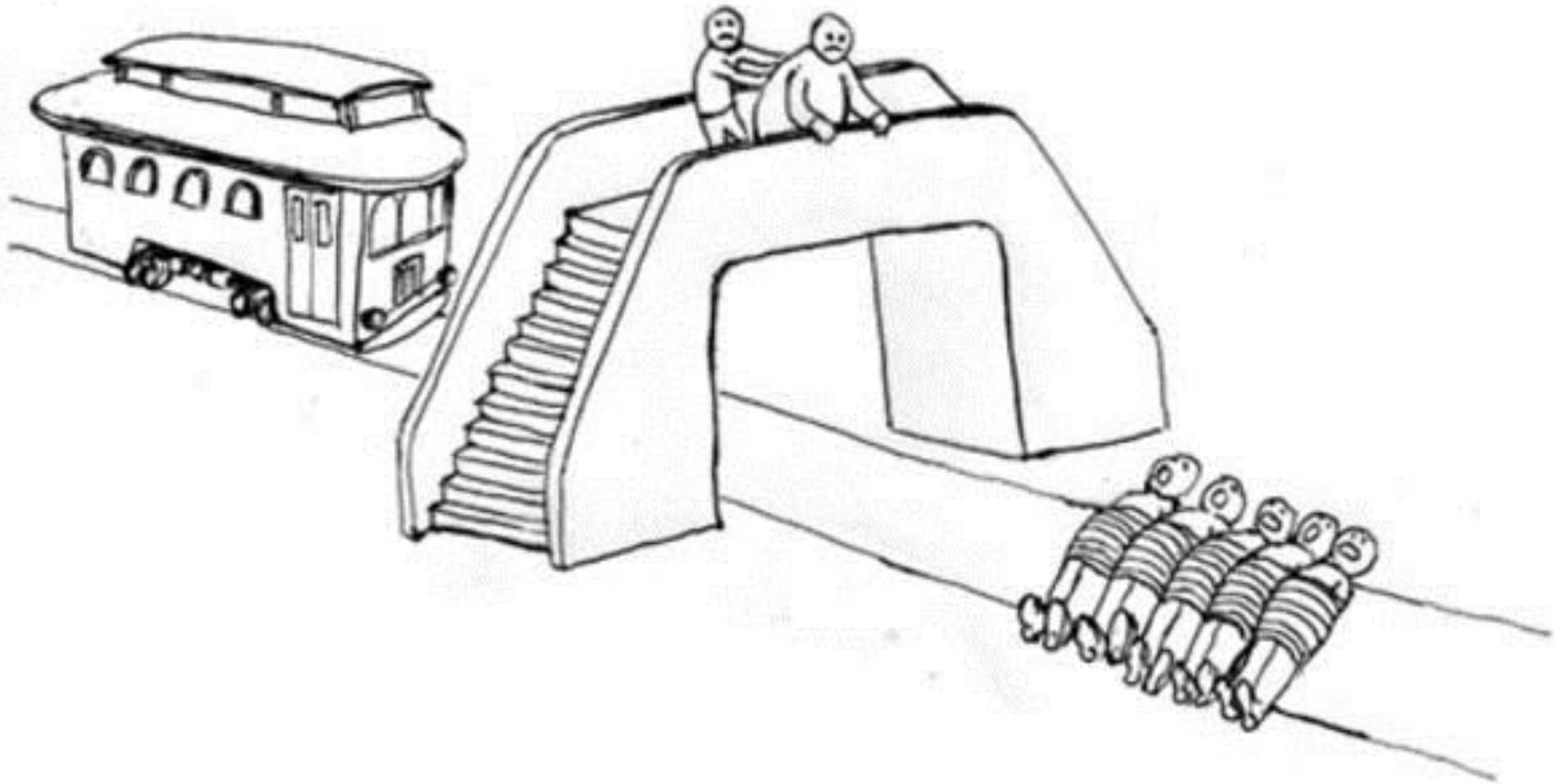
- Questions?

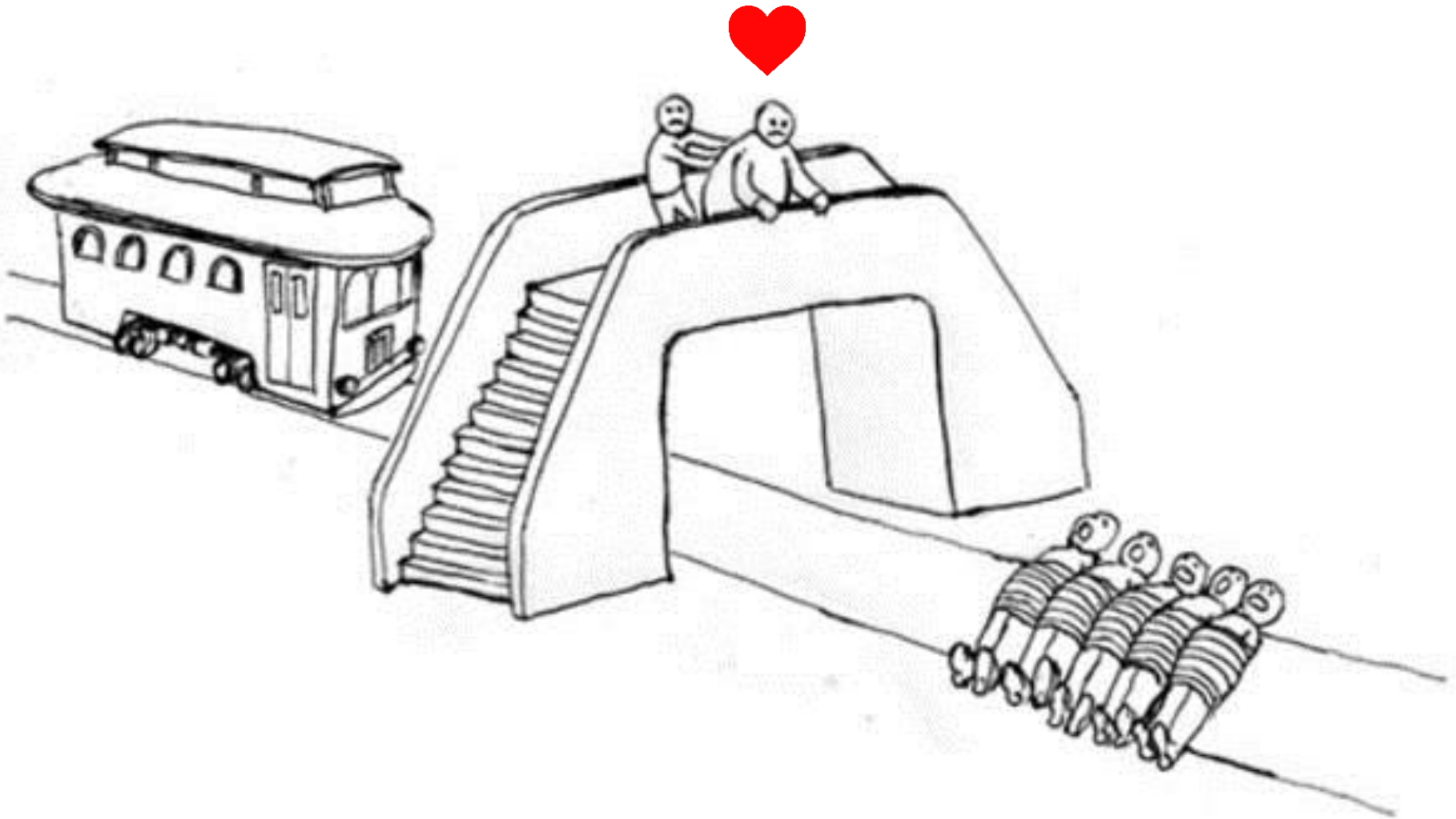
Jen Boger

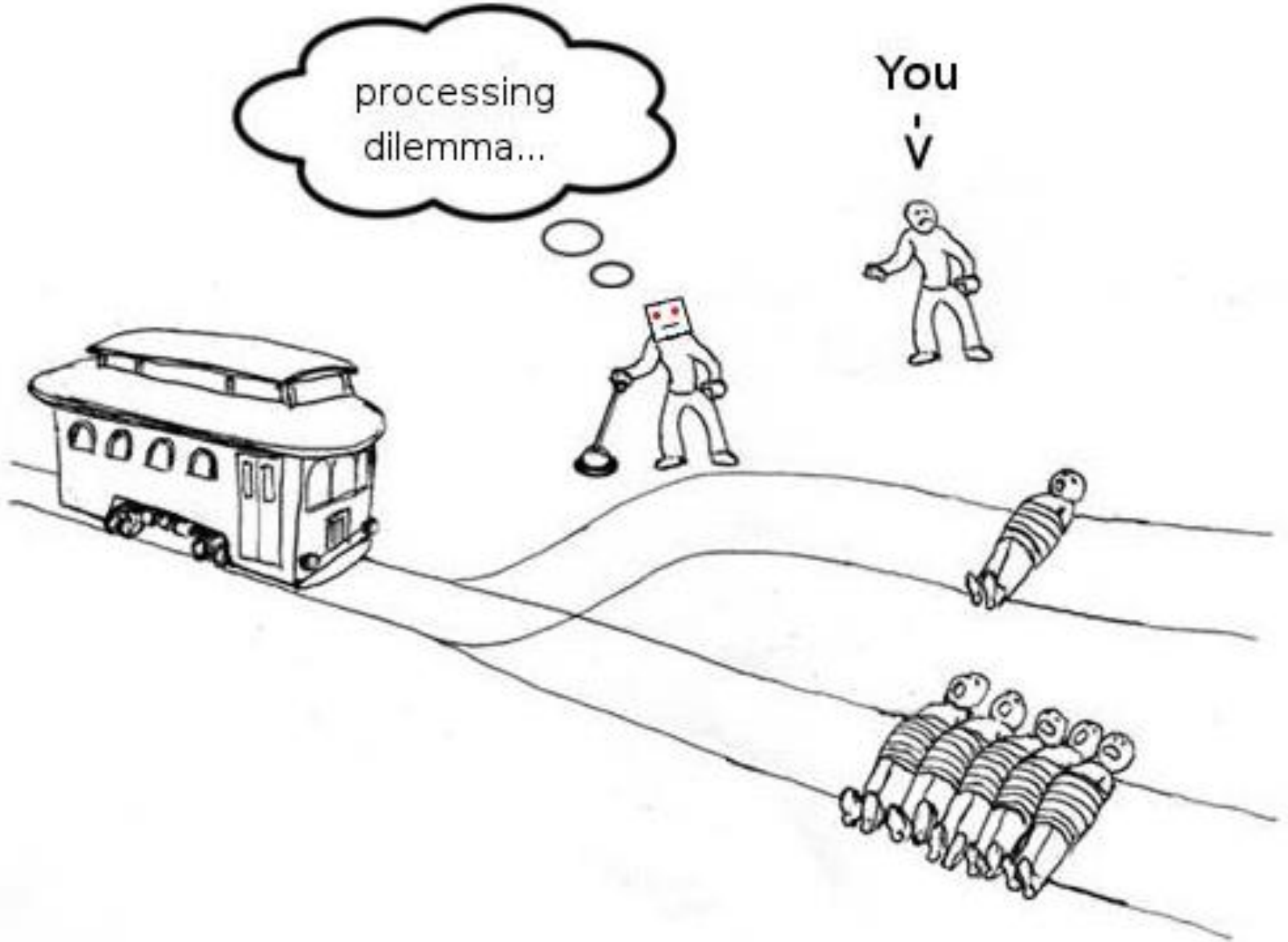
- Biomedical Engineering Ethics – 3rd year core course





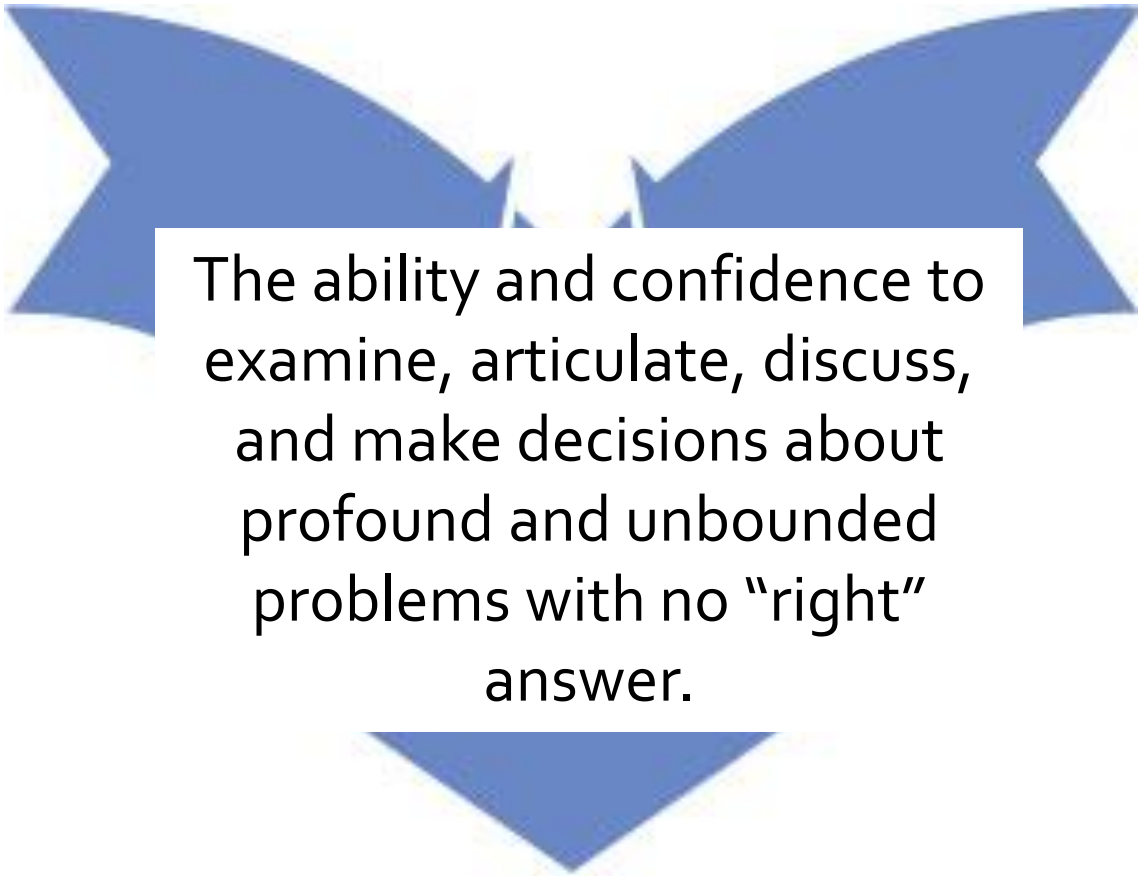





processing
dilemma...
You

What is biomedical engineering ethics?

Biomedical Engineering



Philosophy

Biomedical Engineering Ethics

Approaches we used:

- **Weekly online activities (reading/video + discussion post)**

- In-class activities
  - Code of ethics compare & contrast
  - ALRAP analysis
  - Debates
  - Clickers
- Guest lecturers
- Ethical situation of concern analysis every two weeks
- Written "reflection" assignment (5 page paper)
- Group video assignment

End of term survey:

Students agreed or strongly agreed that…

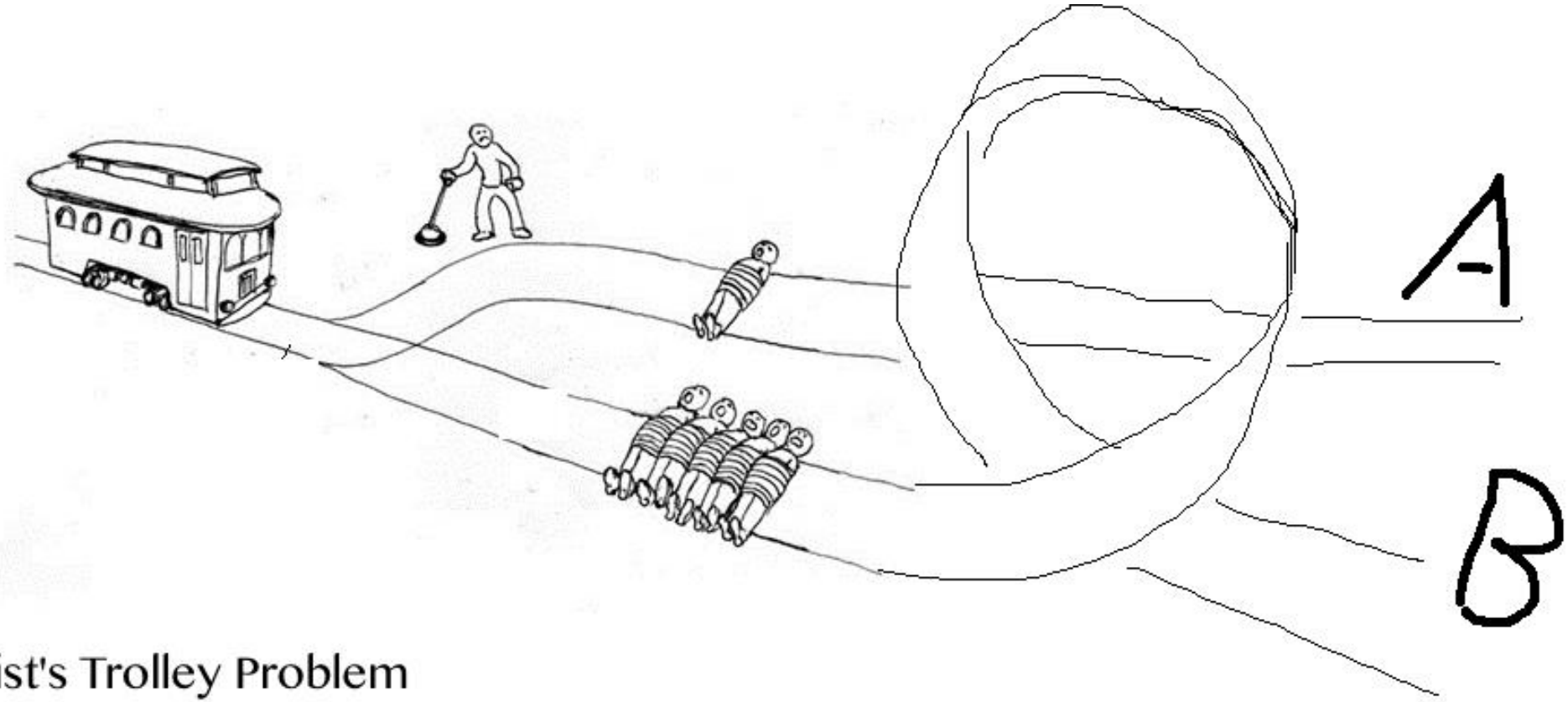
- Course was interesting - 61.5%
- Enjoyed the course – 61.5 %
- Could see how what they learned would be useful in their future career – 61.5%

What they liked:

- Learning about and applying philosophical thinking
- Engaging in group discussion / debates
- Guest lectures

What they didn't like:

- **Reading!!**
- Workload was too high compared to other courses



Hedonist's Trolley Problem

The track is heading towards B.

If you pull the lever, it will switch to A but it won't do the totally sick loop-da-loop.

Jen Boger

- Questions?

- See the ethics videos at:
- https://www.youtube.com/playlist?list=PLqlETQfQKkZx6NC4ypwEaGoOf222Ya0q4

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