Active learning and lesson design

PANOSC Training of Teachers
Workshop Day 2

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While we wait to begin

If you haven't already done so, make a page on your pan-learning course for your reflections.

You will get opportunities to write down during the day.

Today’s agenda

9:00 – 10:15
Presentations and feedback.

10:15 – 10:30
Break – step away from the computer

10:30 – 11:15
Active digital and blended learning

11:15 – 11:30
Break – step away from the computer

11:30 – 12:00
Feedback in digital and blended environments

12:00 – 13:00
Lunch – step away from the computer

13:00 – 14:00
Example digital lesson: Conceptual networks in mechanics

14:00 – 15:00
Analysis of example digital lesson

15:00 – 17:00
Use our analysis of digital lesson to create your own lesson

Presentations in FB groups (~1h15m)

- A person presents activity and explains what students should learn by doing it (for about 5-10 minutes)
- The presentation *could* involve that the FB Group tries out part of the activity.
- The other persons in the FB group provide constructive, caring, and clear feedback (10-15 minutes).
- Some points of interest:
  - Is it a good type of activity for what students should learn? Could other activities work?
  - Is it clear from a student point of view what the student should do? How could it be made clearer?
- You have about 15~20 minutes per person.
- Sum-up the feedback on your reflection page during the last 15 minutes

https://drive.google.com/file/d/1Mp88S6uHDzzDo0zIhrJmEMp1WzDajC92/view?usp=sharing

Break until 10:20
Step away from computer
Avoid temptation to answer mail!

The goals for the next ~45 minutes

- Derive main points in two illustrative papers on active learning
- Use research on digital learning to reflect on own digital teaching

What do you associate with *Active Learning*?

- Write in chat

Results from papers in PNAS (~20 min)

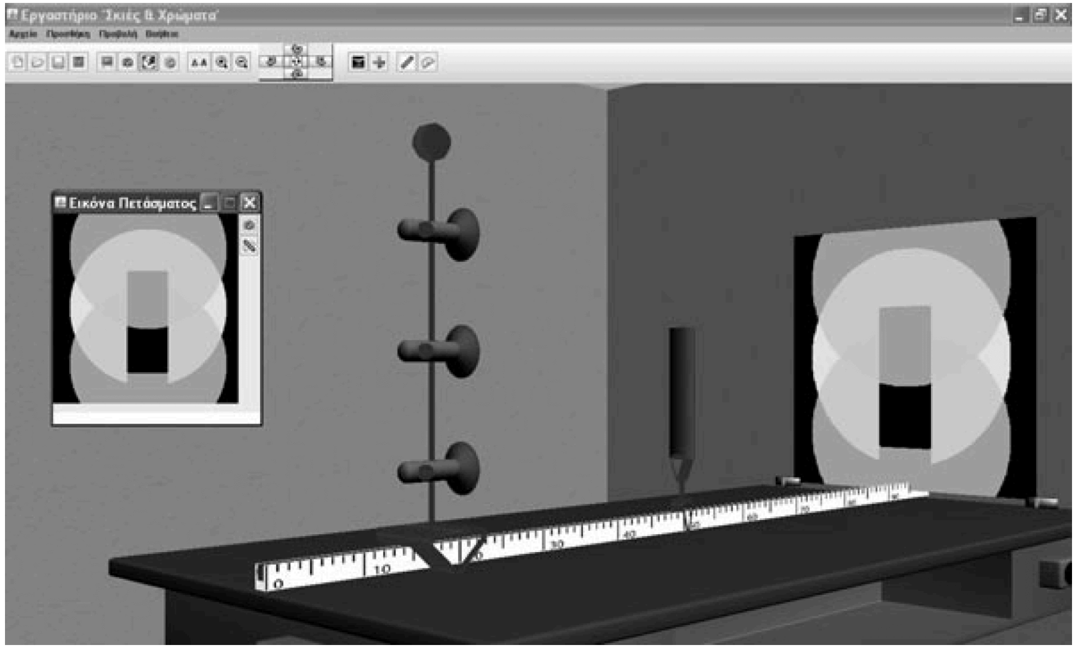
https://ucph.padlet.org/jbruun/twoPapers

READ THE HAND-OUT

DISCUSS: WHAT SEEMS TO BE THE MAIN TAKE-AWAY FROM THE PAPER

WRITE MAIN TAKE-AWAYS ON PADLET

Physical Manipulatives (PM) and Virtual Manipulatives (VM)



Virtual work-bench mimics the real work bench that students would use for physical experiments

Idea: PM and VM have different strenghts and weaknesses

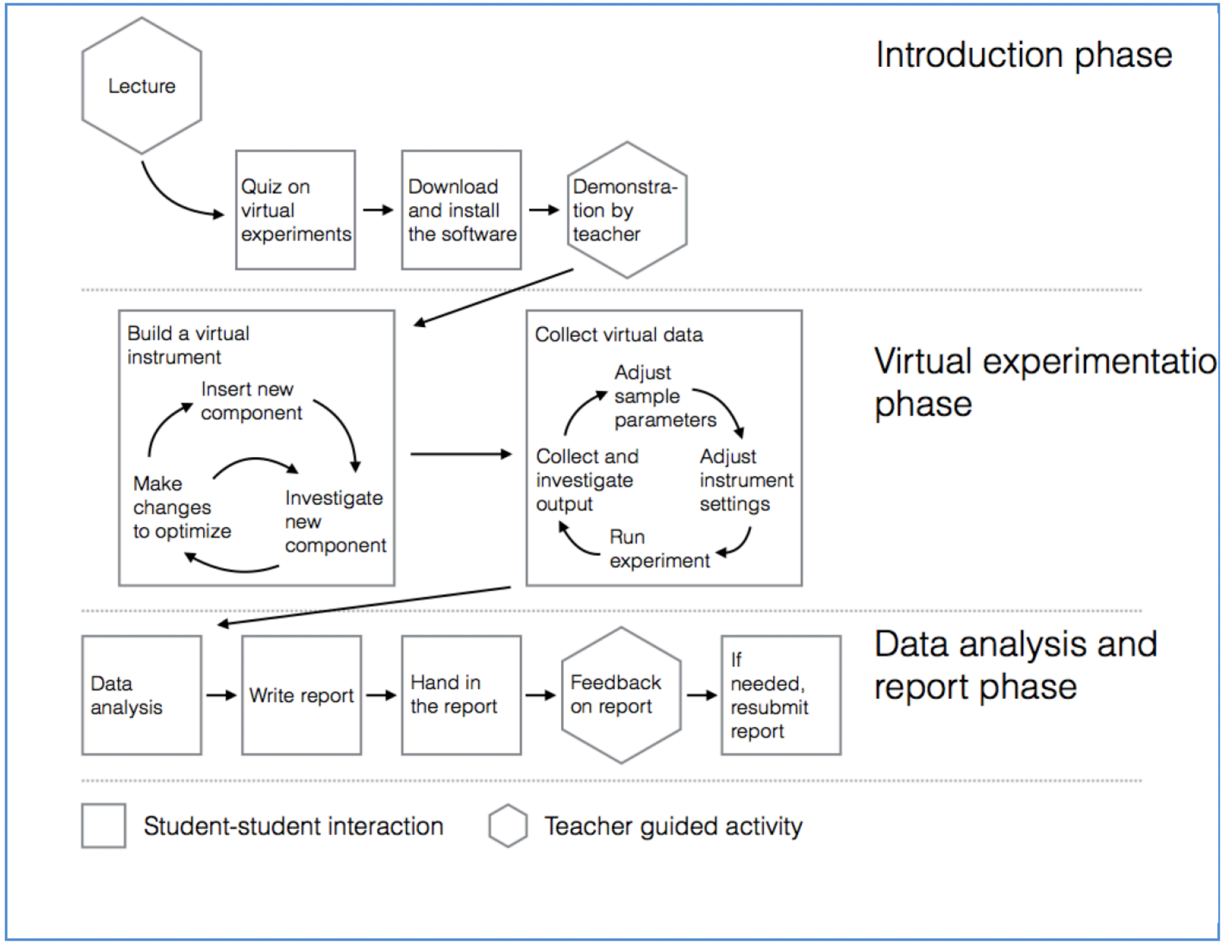
PM: Observe real phenomenon, experience characteristics of objects, allows for building motor skills for handling apparatus

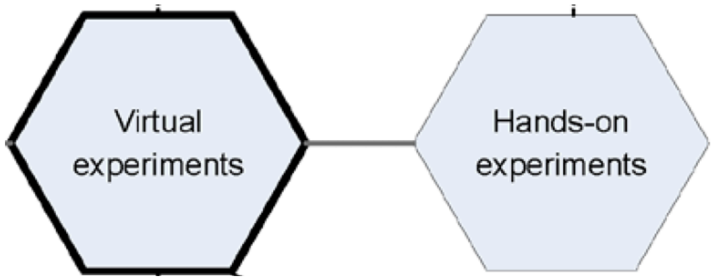
VM: Observe "hidden" phenomena, fast repeated experiments, controlled measurement error, controlled measurement mistakes

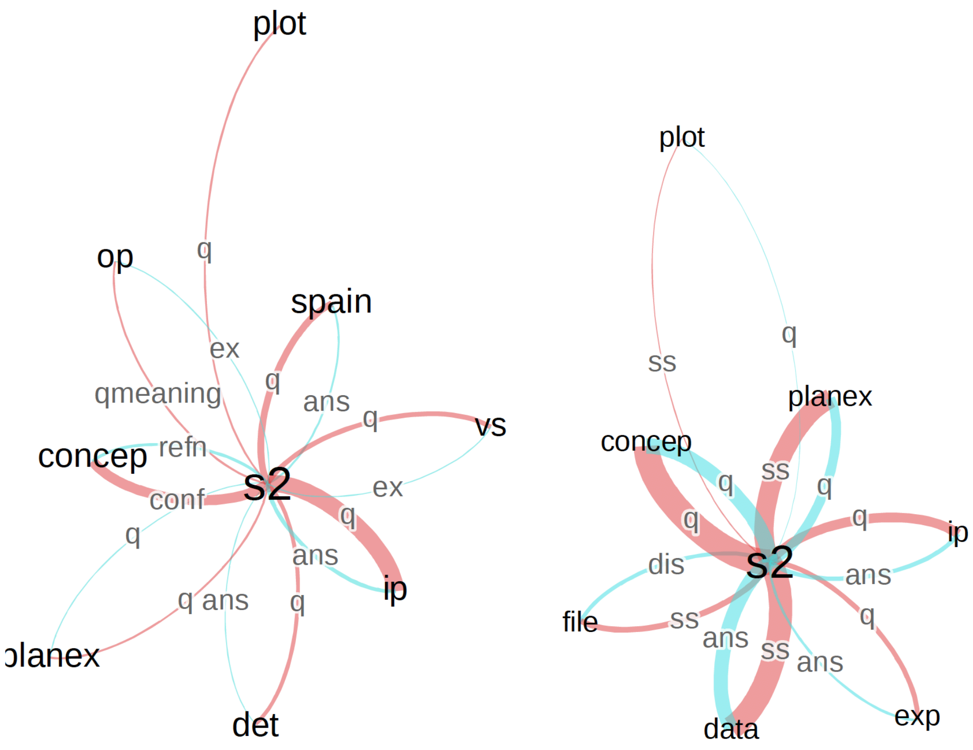
Olympiou & Zacharia: Blending PM and VM outperforms PM and VM alone, at least when PM+VM condition is integrated

Olympiou & Zacharia 2011

Adapting PM-VM approach to NS-course







(a) Simulation situatiuon (b) Experiment situation

Overgaard et al 2016, Overgaard 2015

Multiple choice questions

MC-questions are primarily used for assessment purposes

- Grading
- ”Check your understanding”

Domains for optimizing MC-questions

- Assessment quality
- Fairness
- Feedback
- Formatting
- Cheating countermeasures

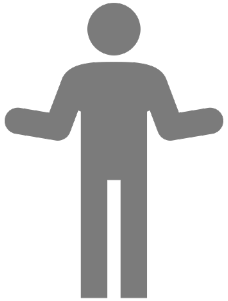
Xu et al 2016,

Advice for assessment quality and feedback (selected)

Assessment quality

Utilize questions designed for higher-order cognitive assessment

Improve quality [of exams] by conducting item analyses



Feedback

Timing (i.e., immediate or delayed) of feedback should be based on difficulty level of item and context of the assessment.

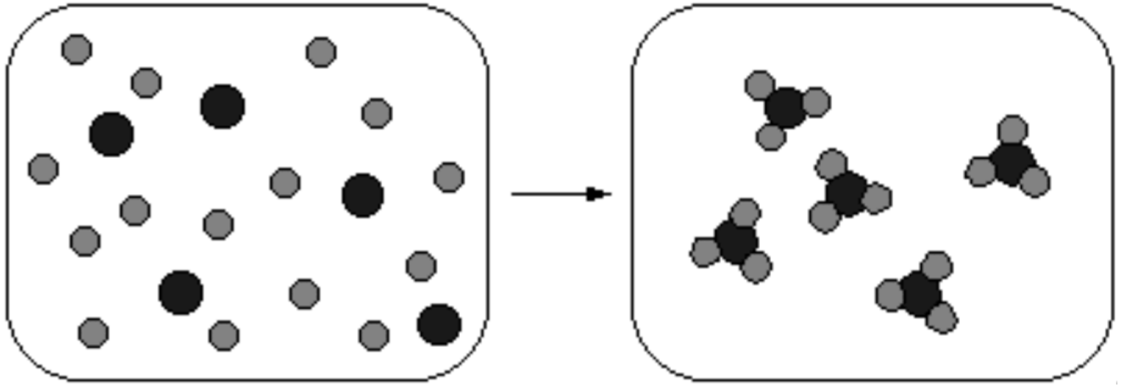
Give students opportunities to self-correct.

Provide elaborate and timely feedback for online assessments using software.

Solicit feedback on assessments from students.

An example of rich feedback

2. The following diagram shows a compound reacting to form products. Which equation best describes the stoichiometry of the reaction shown in the diagram?



1) $A+3B \dashrightarrow AB_3$ 2) $A+B \dashrightarrow AB_3$ 3) 5A+5B-->5AB 4) $5A+15B \dashrightarrow 5AB_3$

1) Correct. The expression reflects the molecules in the diagram, balances the number of atoms, and reduces the coefficients to the simplest ratio. If you weren't sure, you should read Section 4.2 and do homework problems 14,16 and 86.

2) This expression does not have the number of atoms balanced. You need to make sure the expression reflects the molecules in the diagram, balance the number of atoms, and reduce the coefficients to the simplest ratio. You should read Section 4.2 and do homework problems 14,16 and 86.

No difference in student achievement for rich vs. simple feedback, but:
"Many confounding factors may have obscured this result, however. One of these is a great deal of anecdotal evidence that the cohorts were not isolated as to the experimental treatment. Several students assigned to text-based homework sections reported accessing their friends' online homework in order to obtain the feedback on the material." p. 1342

Cole & Todd 2003

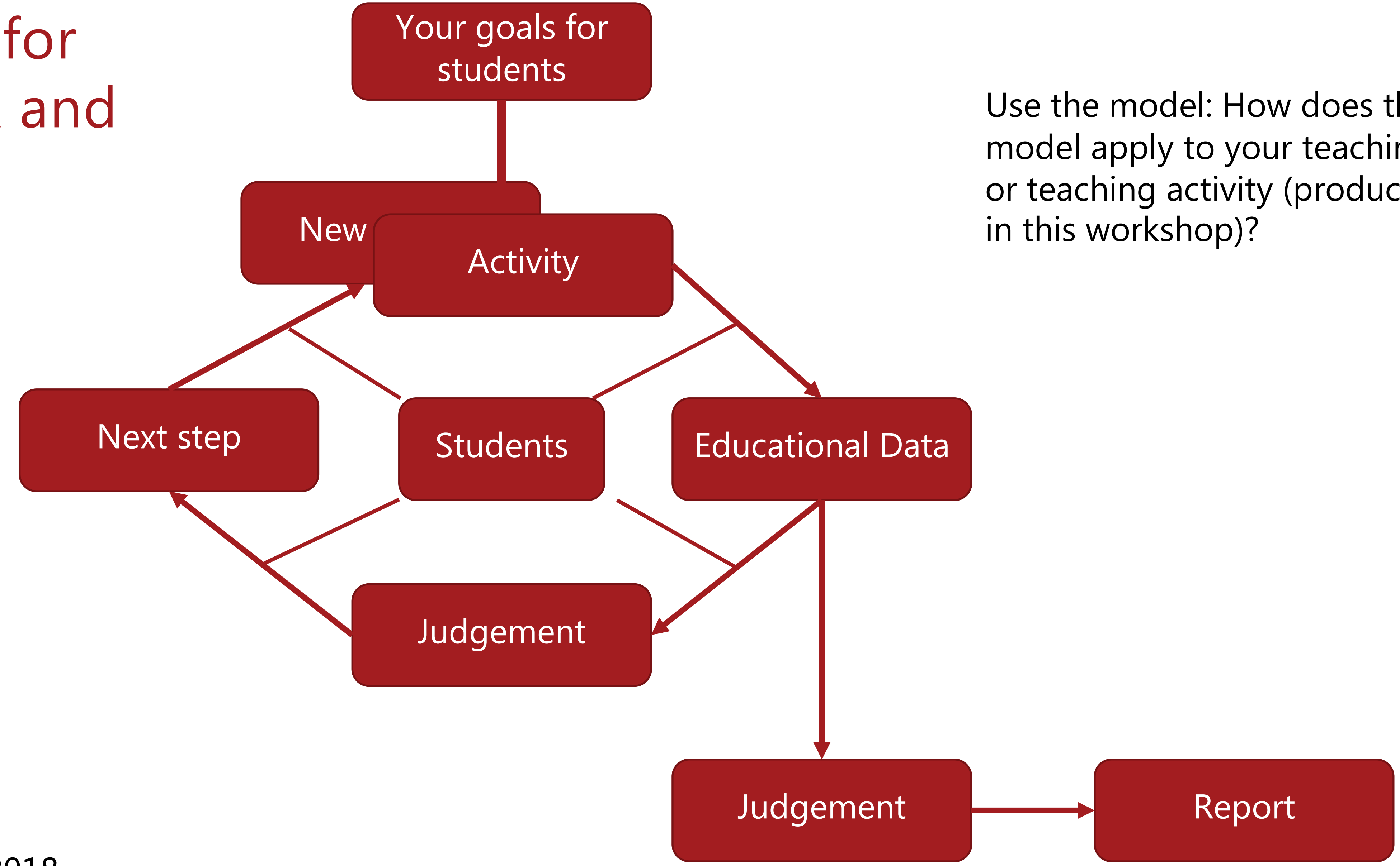
Active digital learning in your teaching?

Go to your reflection page on your course on pan-learning

From what you know now, write one thing that you believe could be an active learning activity with an online or blended element.

Break for 10 minutes
Step away from computer
Avoid temptation to answer mail!

A model for feedback and learning



Use the model: How does the model apply to your teaching or teaching activity (produced in this workshop)?

After Dolin et al 2018

https://drive.google.com/file/d/1hZoe_ychamXoIWFvqj0yf6pqSXZANsdo/view?usp=sharing

Feedback in online and blended learning environments

Automated feedback. Unique to digital formats. A particular response is recognised by system and produces a pre-defined piece of feedback. (See Rienecker & Bruun 2017)

Peerfeedback. Student upload work and are automatically assigned others' work to provide feedback on. (See e.g. Cho & Schunn 2007)

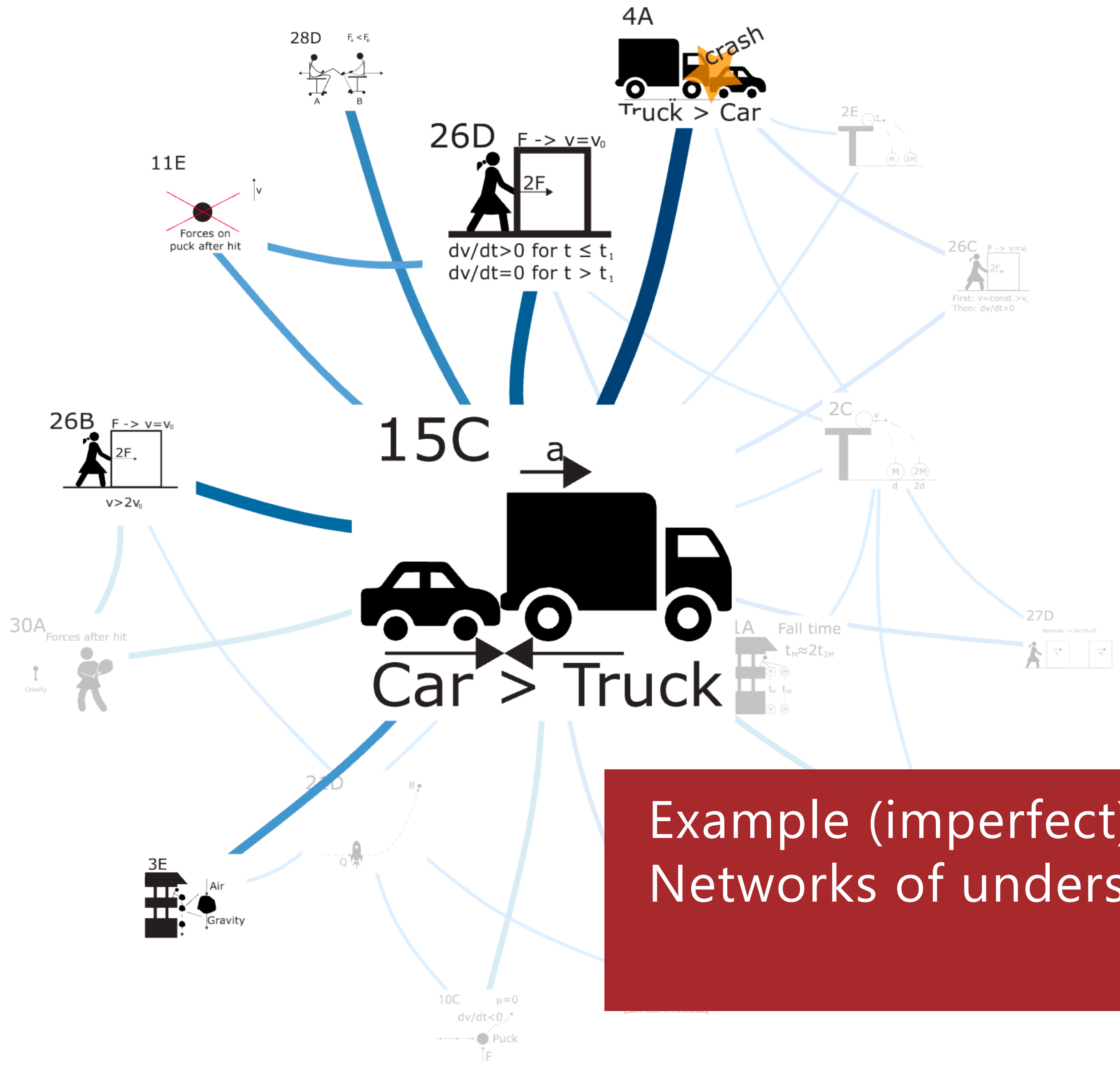
Self-evaluation. E.g. looking at own contribution after having provided feedback to others. (See, e.g., Topping 2013)

Teacher feedback. Teacher uses student products to provide feedback.

A model for creating automated feedback

Create task	Ask student to do a task, which you can assess on some quality parameter
Collect solutions	Have (many) students solve the task and collect their solutions
Categorise	Categorize student answers according to the quality parameter
Formulate feedback	Formulate feedback which may help students provide a higher quality answer
Try out	Try out and ask students if the answers helped them

LUNCH until 13:00
Step away from computer
Avoid temptation to answer mail!



Example (imperfect) lesson: Networks of understanding

Goals

After this lesson you should be able to

- Interpret clusters of distractors for a particular set of multiple choice questions
- Provide ideas for how a particular clustering method for student responses might be usable in your field

Meta goals

- Participate in and analyse a lesson based on a research-based model for science teaching
- Discuss the use of online activities in the lesson and suggest changes

Have you ever heard about..?

THE FORCE CONCEPT INVENTORY?

NETWORK ANALYSIS?

Once upon a time in the 80's

College physics teachers in USA became worried

Physics students were very good at calculations

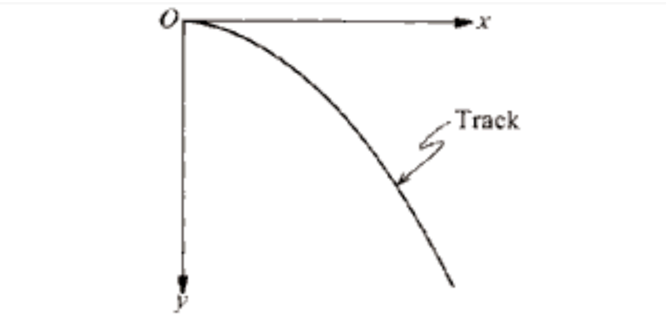
But, did they learn to think physics?

The answer was

NO!

Physics teaching did not change students' ideas about physics at all!

Well, they learned *something* – just not what teachers thought



6. A particle is initially at rest at the top of a curved frictionless track. The x- and y-coordinates of the track are related in dimensionless units by $y = \frac{x^2}{4}$, where the positive y-axis is in the vertical downward direction. As the particle slides down the track, what is its tangential acceleration?

(A) 0

(B) g

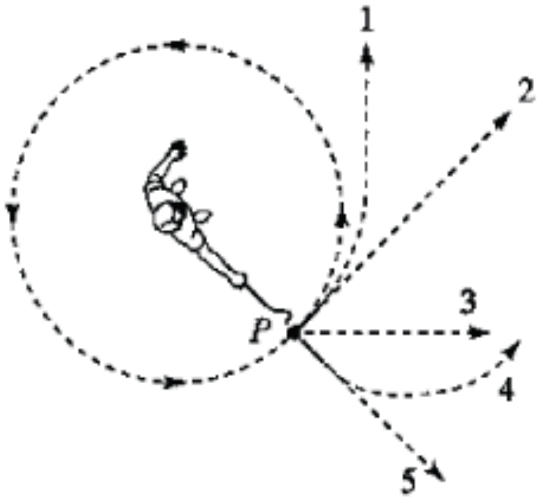
(C) $\frac{gx}{2}$

(D) $\frac{gx}{\sqrt{x^2+4}}$

(E) $\frac{gx^2}{\sqrt{x^2+16}}$

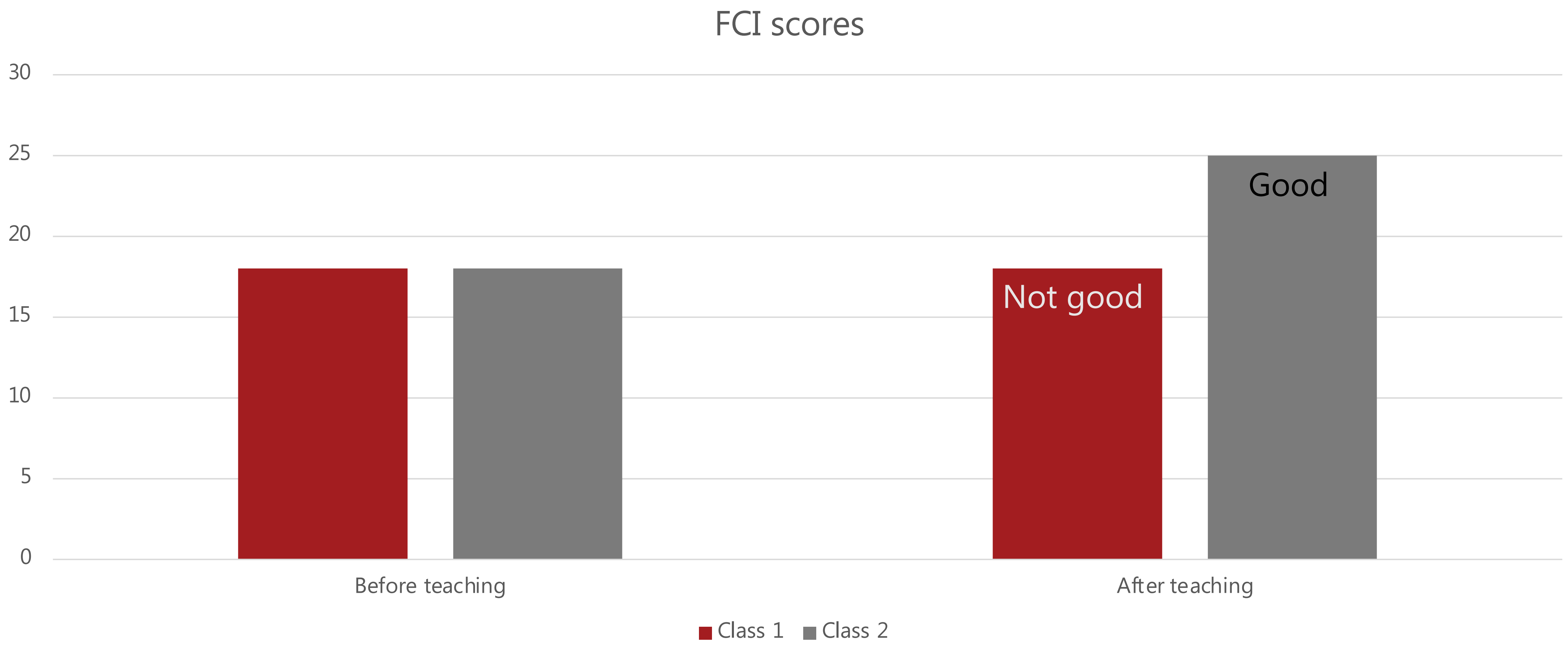
What they learned

What they didn't learn



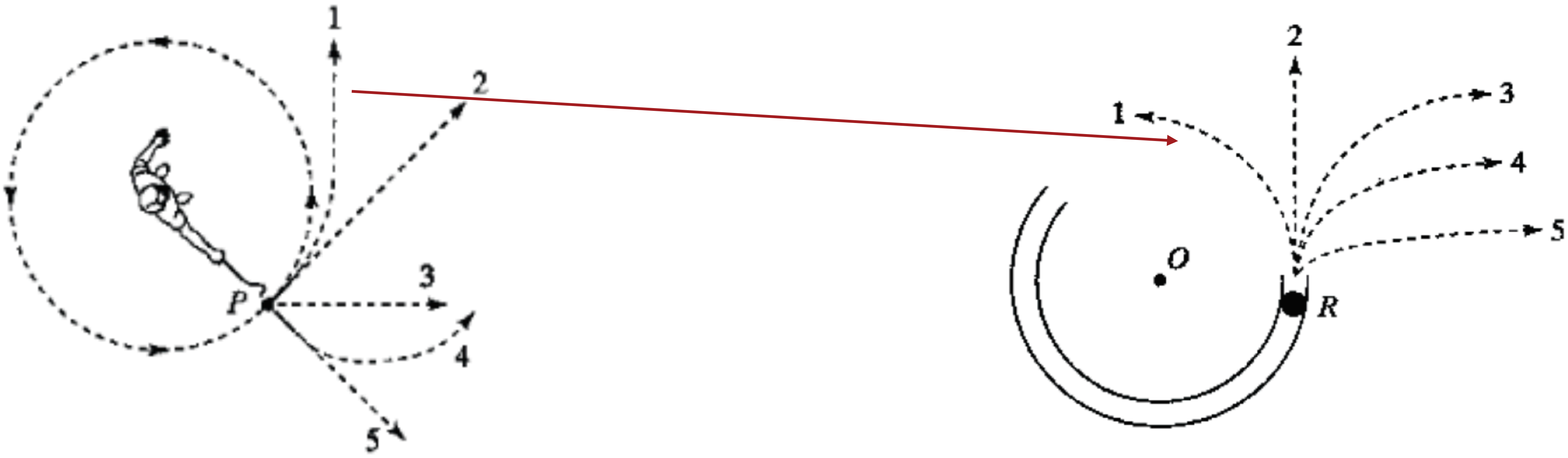
A test was designed with these kinds of questions (Hestenes et al 1992)

Different formats were developed and tested .. Like this:



Appropriate error-bars were sometimes given

But maybe we could gain more from the answers

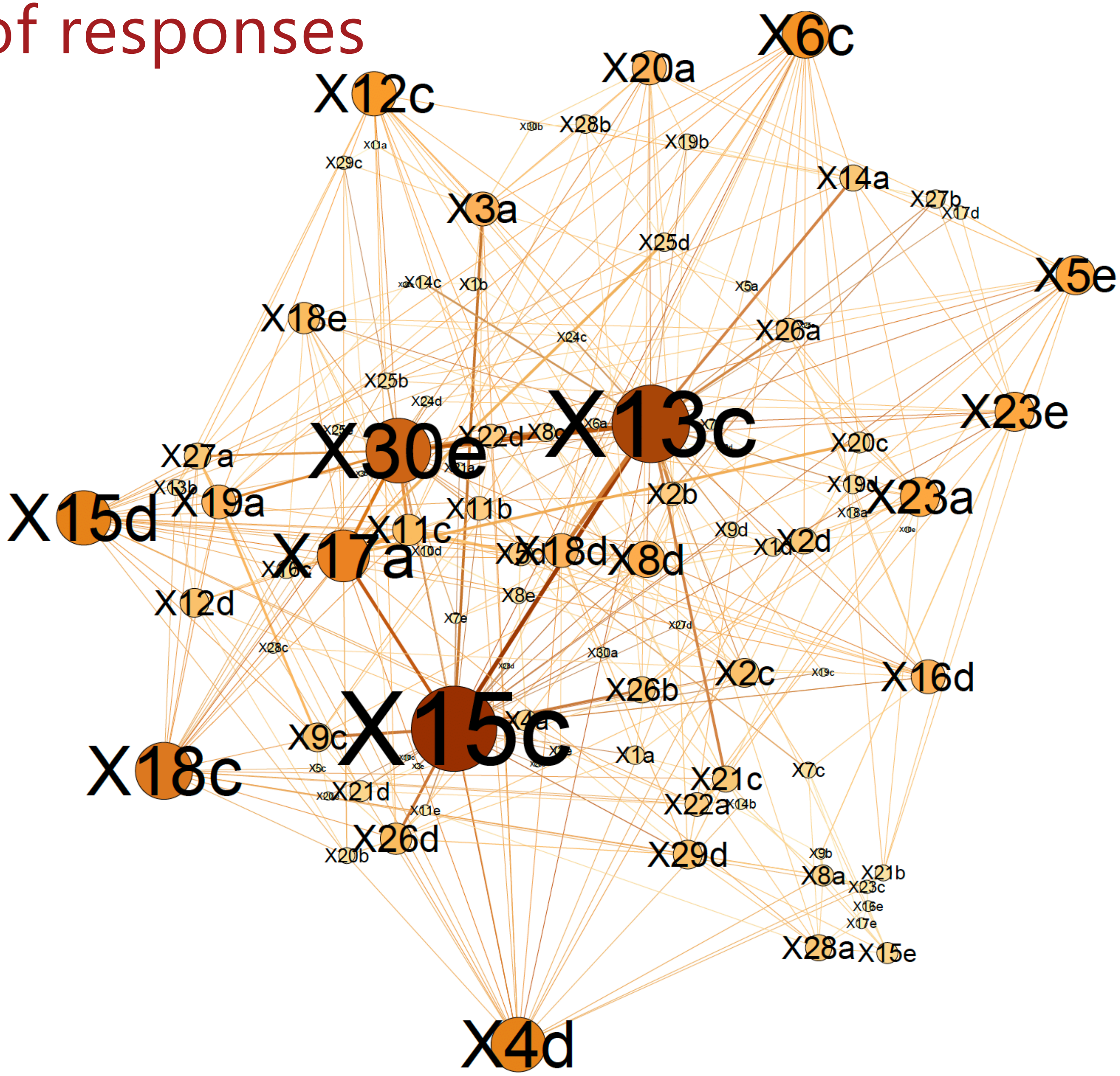


Perhaps some answers were related
Perhaps whole groups of answers were related?
Perhaps this could be used to inform teaching?

The general idea of our analysis

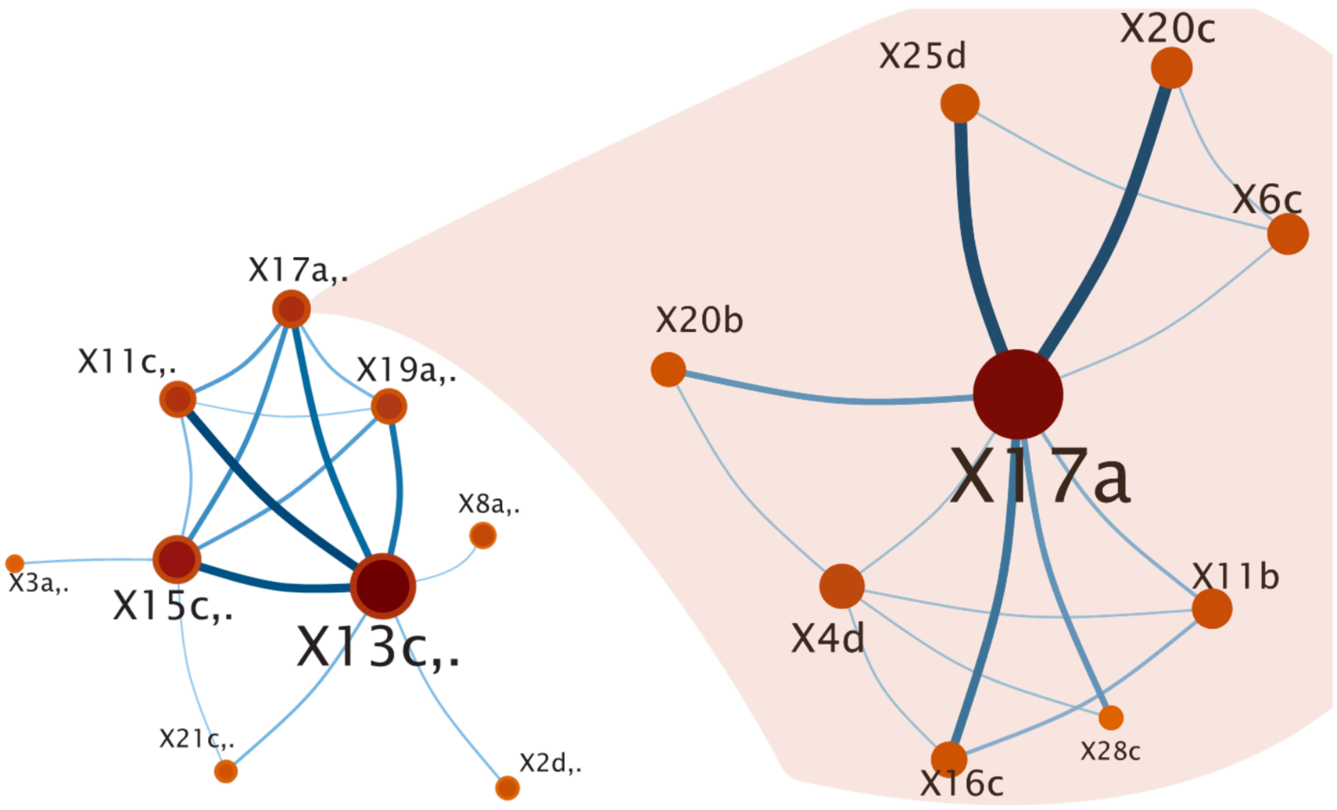
Brewe, Bruun, & Bearden 2016

A network of responses

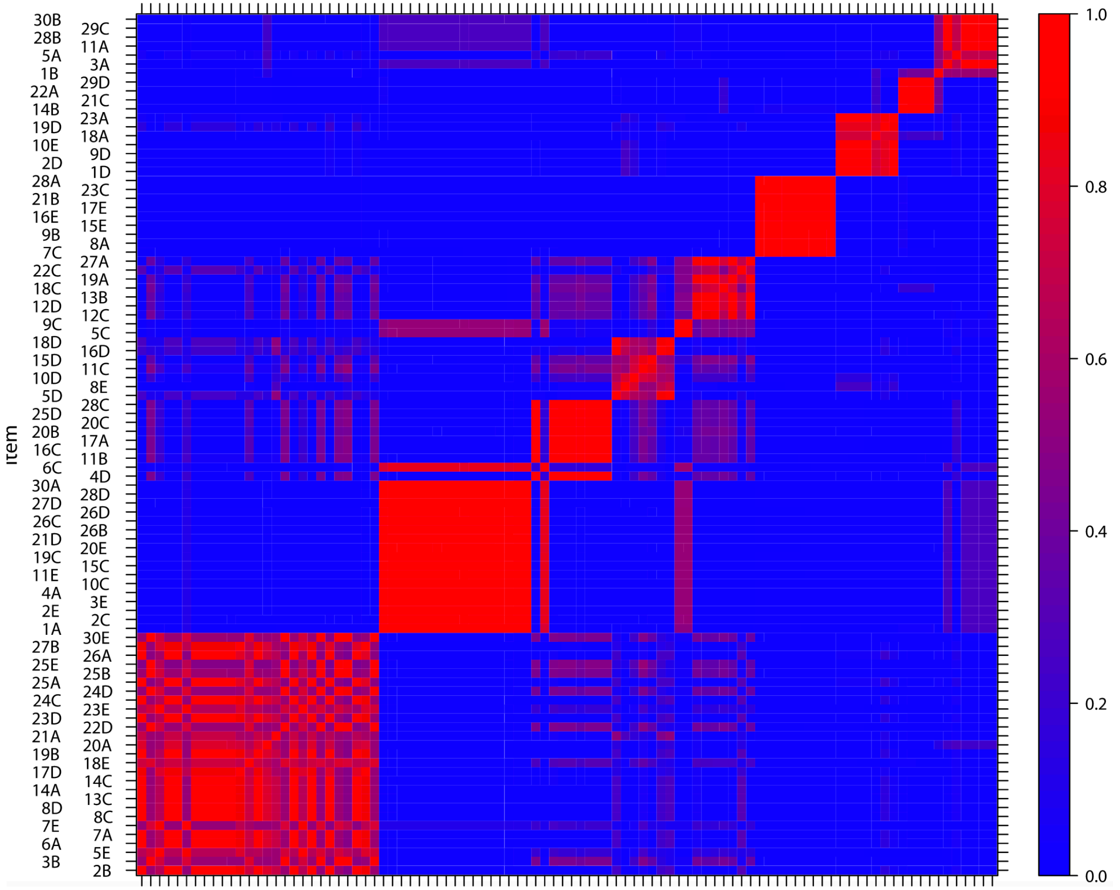


Backbone network

A clustering method divides the network into clusters



A map of the solution



Stability of the solution

Time for you to work (~20 min.)

Modules found with the network method

Modules

View Edit Comments History Map Files Administration

overview

The pages below contain 6 modules of understanding of mechanics using a network method on the Force Concept Inventory.

Find the Force Concept Inventory here (pwd: cannon)

Module 1

Module 2

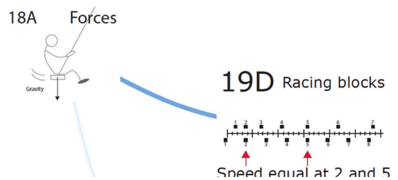
Module 3

Module 4

Module 5

Module 6

Example module:



Go to pan-learning and find Jesper's course

Navigate to the Wiki-activity called:
Modules found with the network method

Break-out rooms will be open – work as a group

Follow instructions and fill out the wiki-page

Group 1 – Module 1, Group 2 – Module 2, ..

Visit another group's work

- Group 1 -> Module 2, Group 2 -> Module 3, ··· Group 6 -> Module 1
- Read throught their work and see if you agree
- Make changes if you do not
- Comment either on changes or comment on why you agree

A few known alternative conceptions in mechanics

IMPETUS

MORE FORCE YIELDS MORE RESULT

CONFUSING ACCELERATION AND VELOCITY

How would such an analysis be relevant to teaching in scattering physics?

- Go back to Jesper's course and participate in the chat!

THE END OF THE LESSON
10 MINUTE BREAK

Analysis of lesson

Individually: Take 5 minutes to write down chronologically, what happened in the lesson.

Group (15-20 minutes): Agree on what happened in the lesson. You may want to divide activities into "chuncks". Give it "chunck" a title/name and consider: (a) what was the role of the teacher, (b) what was the role of the student, and (c) what was the function of the "chunck".

Plenary: We construct our shared understanding of what happened

Break for 15 minutes
Step away from computer
Avoid temptation to answer mail!

Plan a lesson

Use the template handout to plan a digital lesson, which aims at following the structure we just arrived at.

Put in one of the activities, which has already been produced as an Activation phase (or part of one).