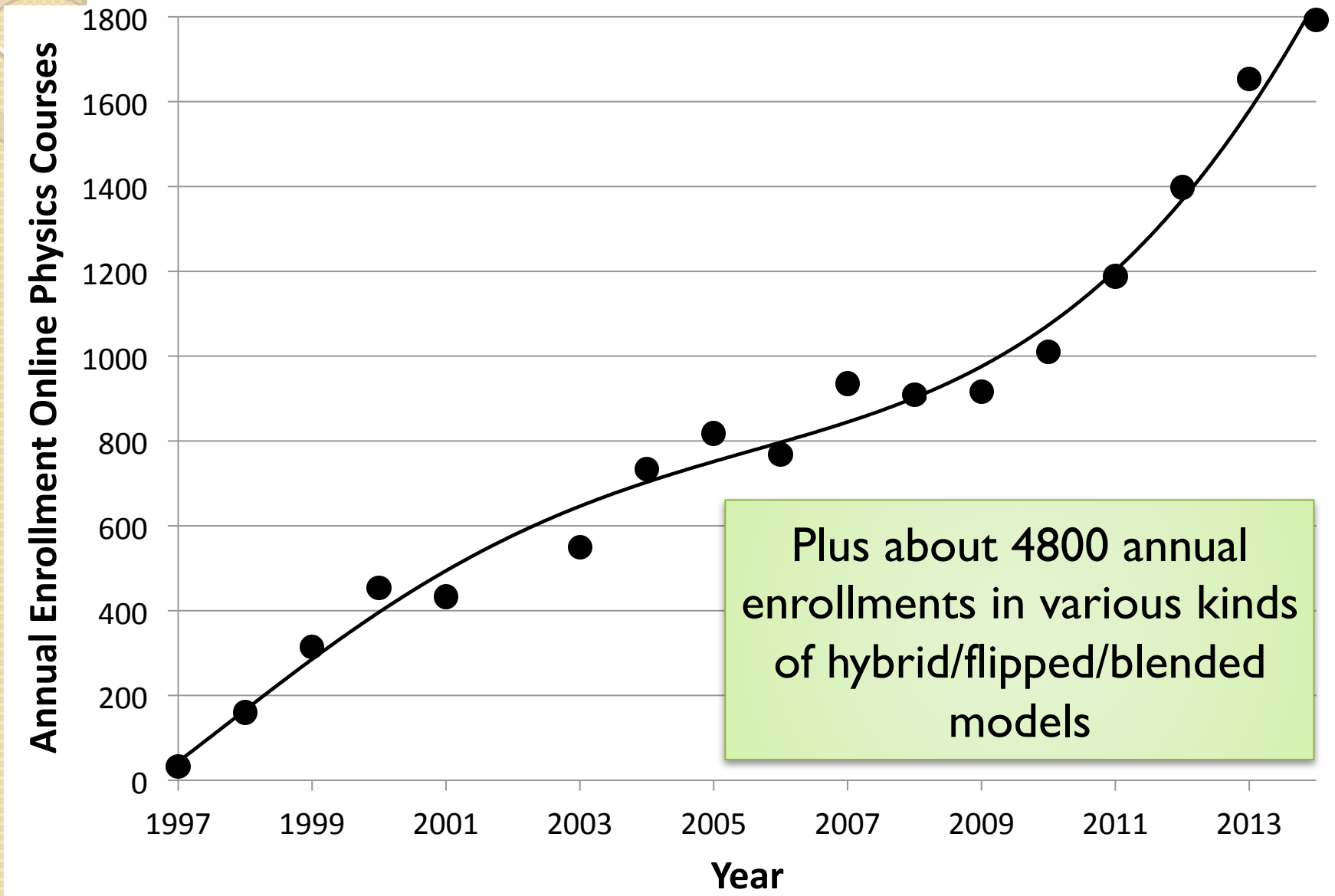
How to Reduce Unproductive and Undesirable Behavior in Online Courses

Gerd Kortemeyer

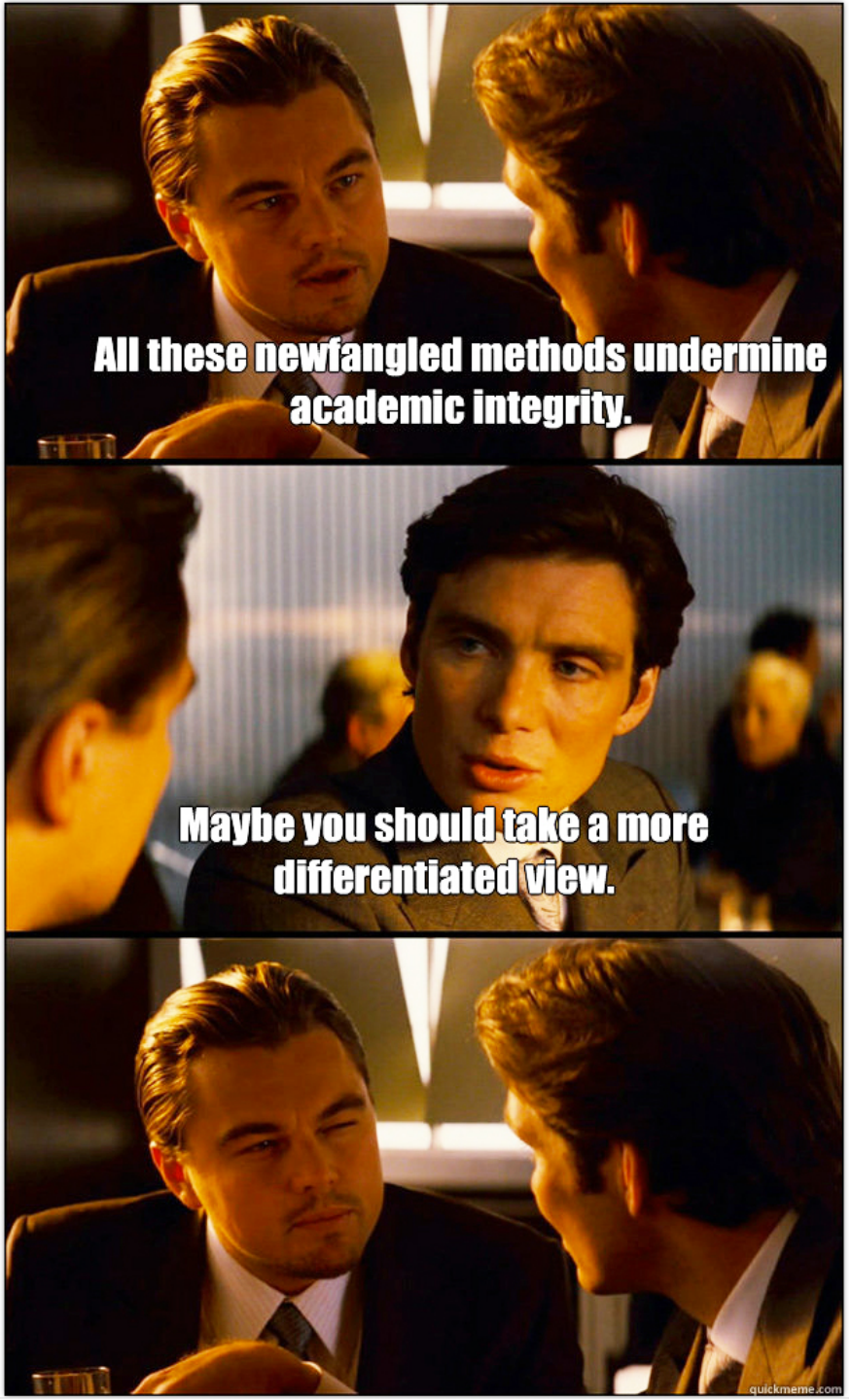
Michigan State University

AAPT Summer Meeting 2014
Minneapolis

Online (for-credit) physics at MSU



Faculty Concerns

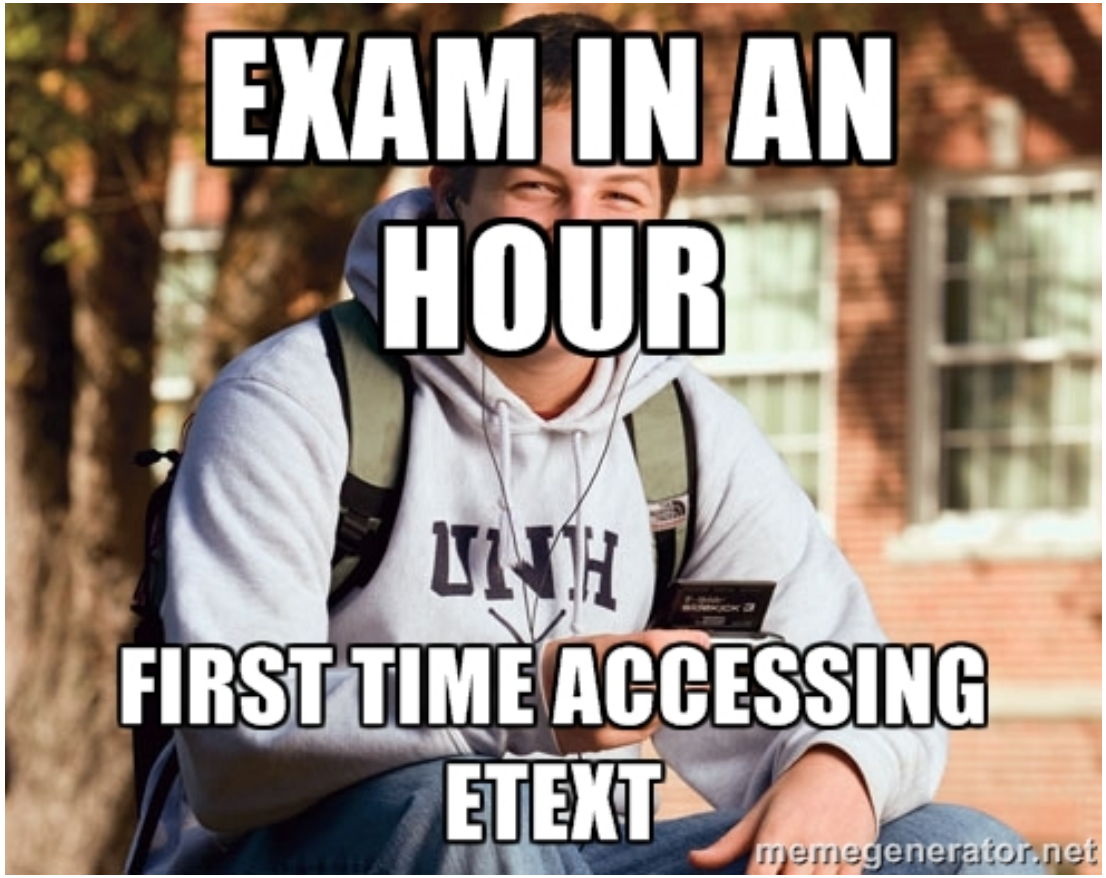


A More Differentiated View

- Cramming
  - Not interacting with the online materials until the "last minute"
- Guessing
  - Submitting "random" guesses to online homework, etc.
- Cheating
  - Submitting other people's work to online homework, etc.

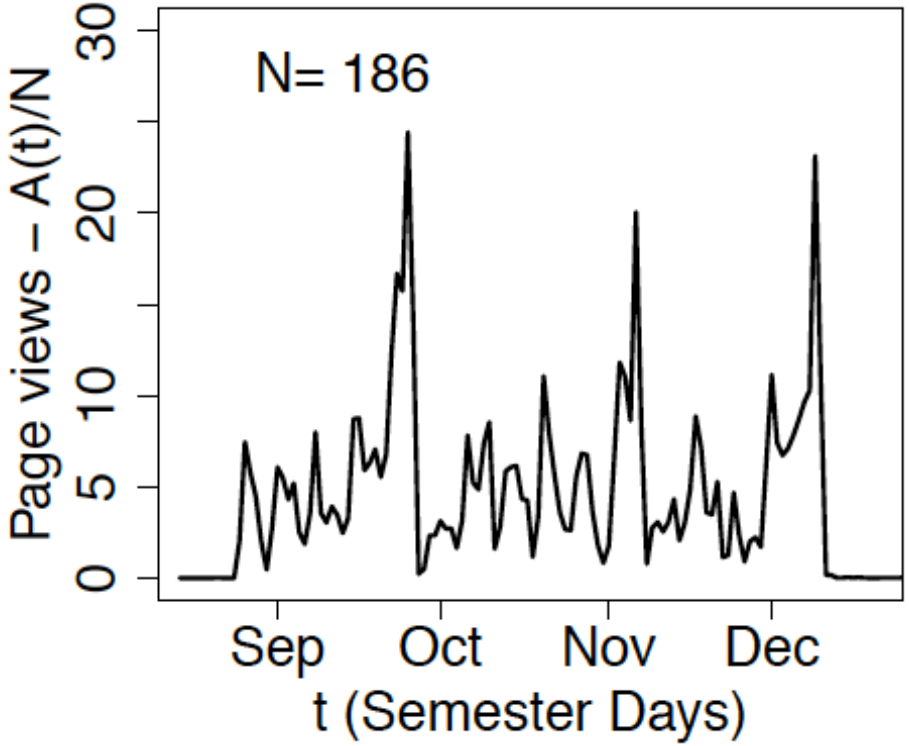
Cramming

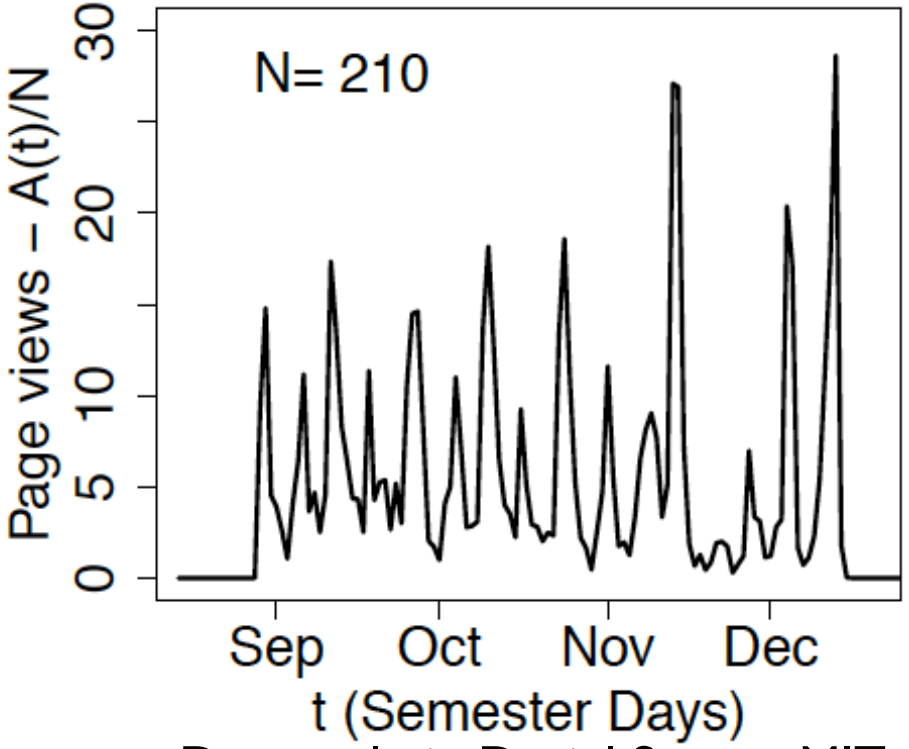
- Courses with online textbooks (e-texts)
- Can actually track use



Cramming

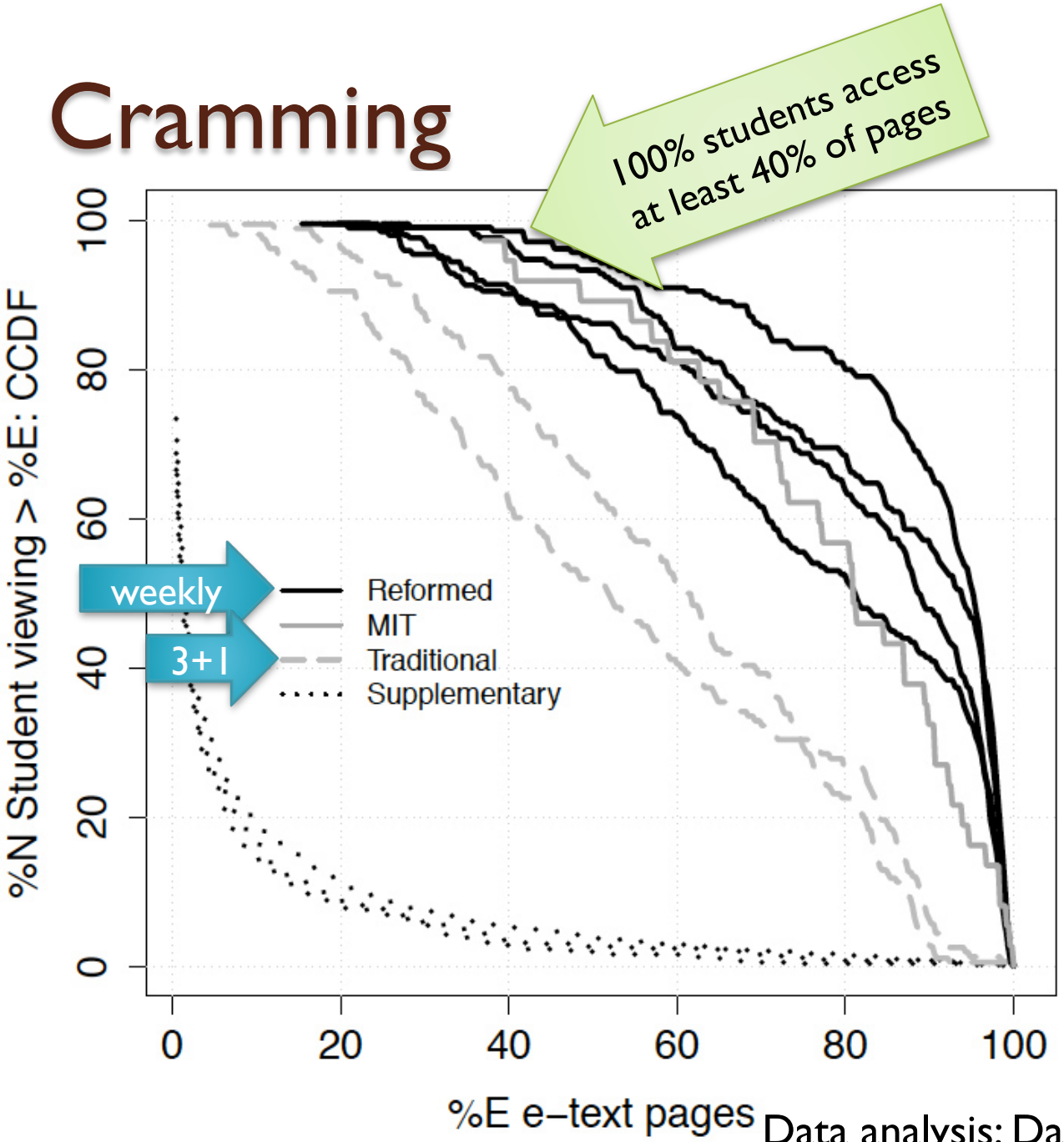
- Two midterms + final (left graph), weekly exams (right graph)
- Guess when these exams took place





Data analysis: Daniel Seaton, MIT

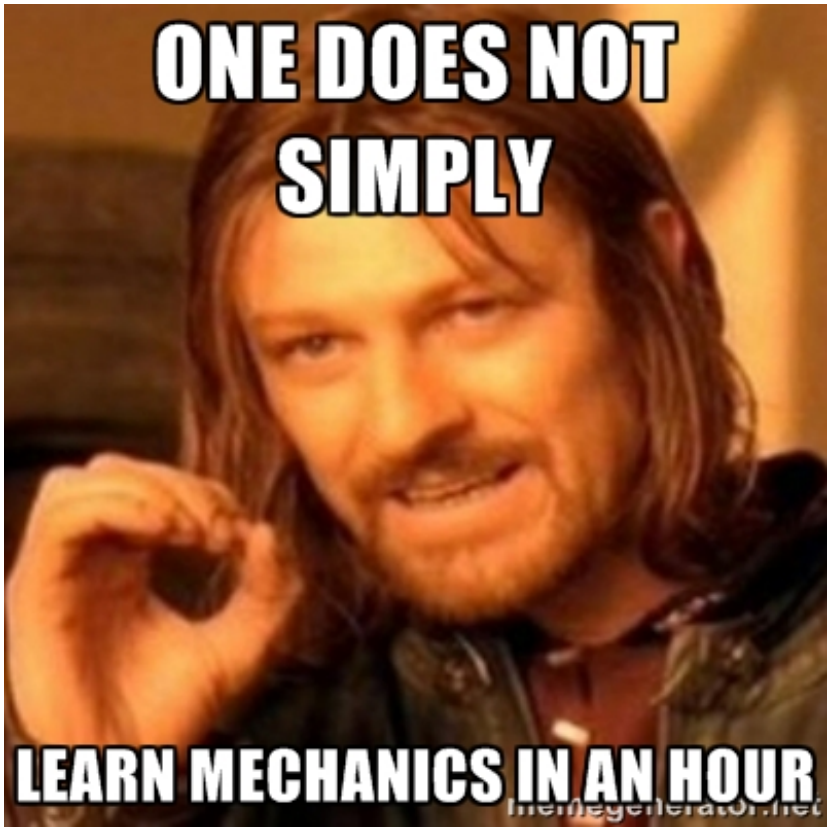
Cramming



Data analysis: Daniel Seaton, MIT

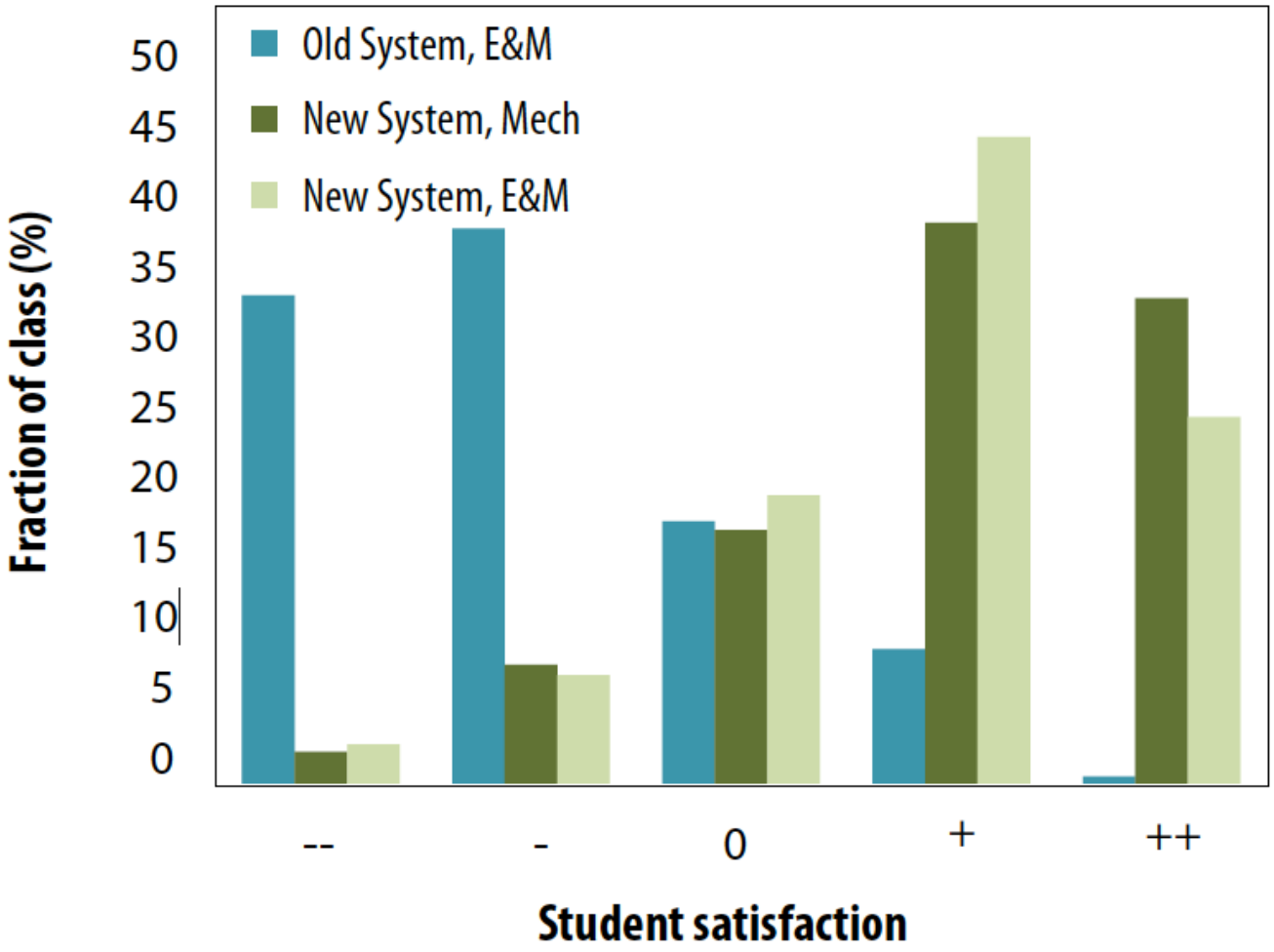
Cramming

- So, not surprisingly, more frequent exams lead to more frequent access of the electronic textbook
  - More distributed over time
  - More pages total



Cramming

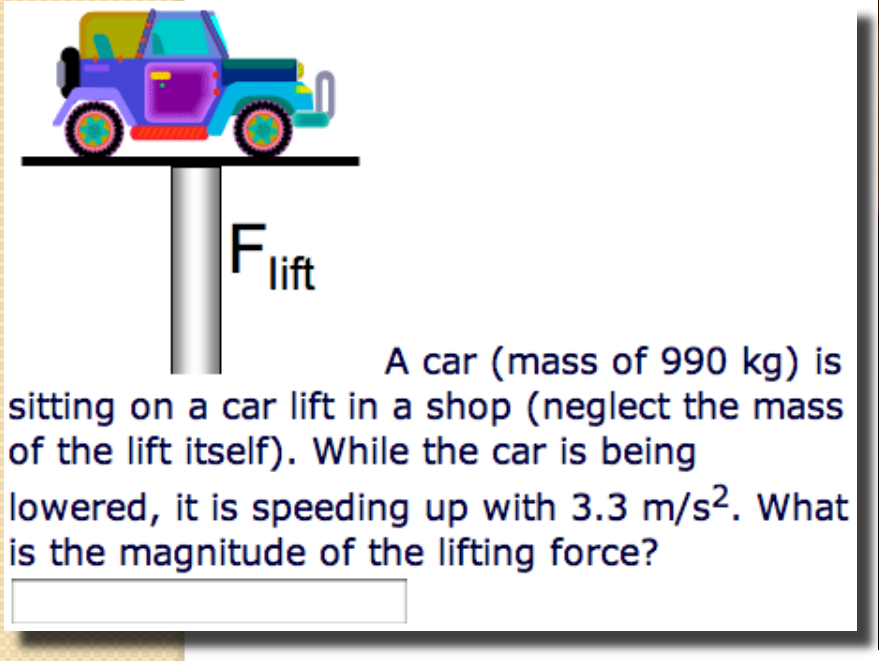
- More exams, unhappy students?

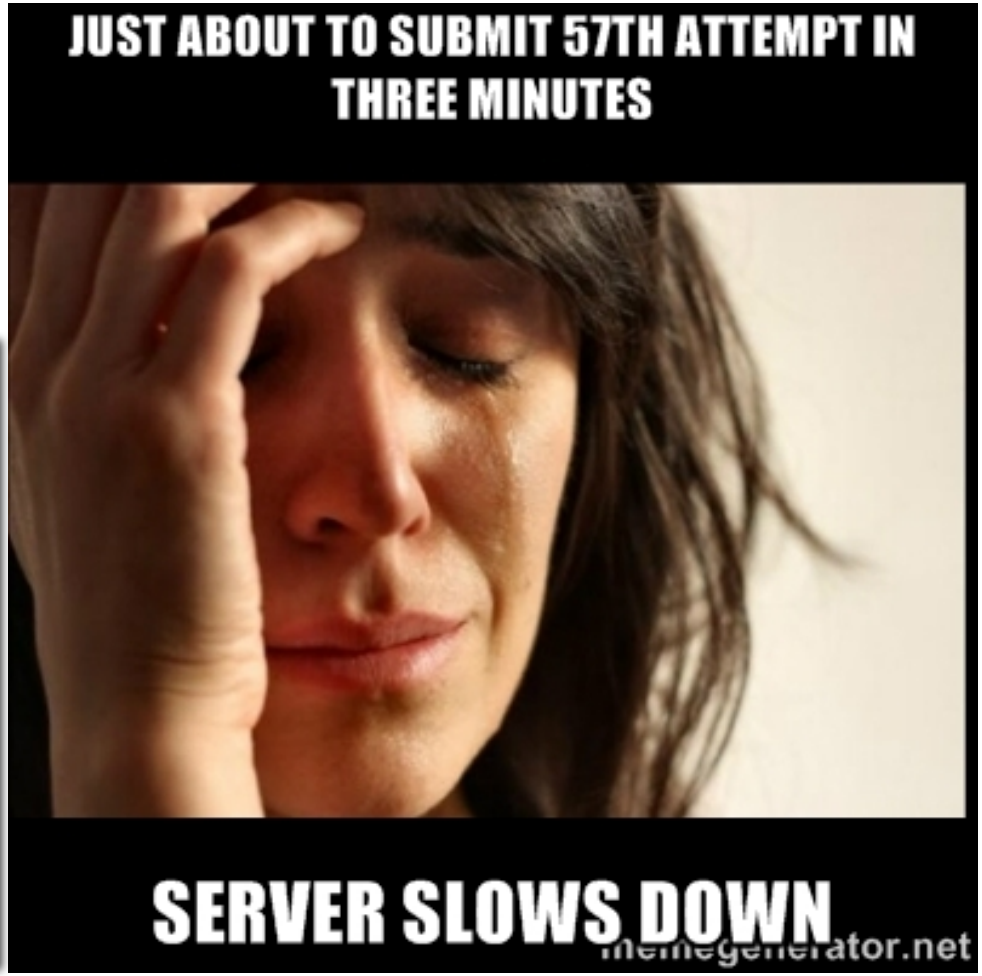


James T. Laverty, Wolfgang Bauer, Gerd Kortemeyer, and Gary Westfall, *Want to Reduce Guessing and Cheating While Making Students Happier? Give More Exams!*, The Physics Teacher **50**, 540-543 (2012)

Guessing

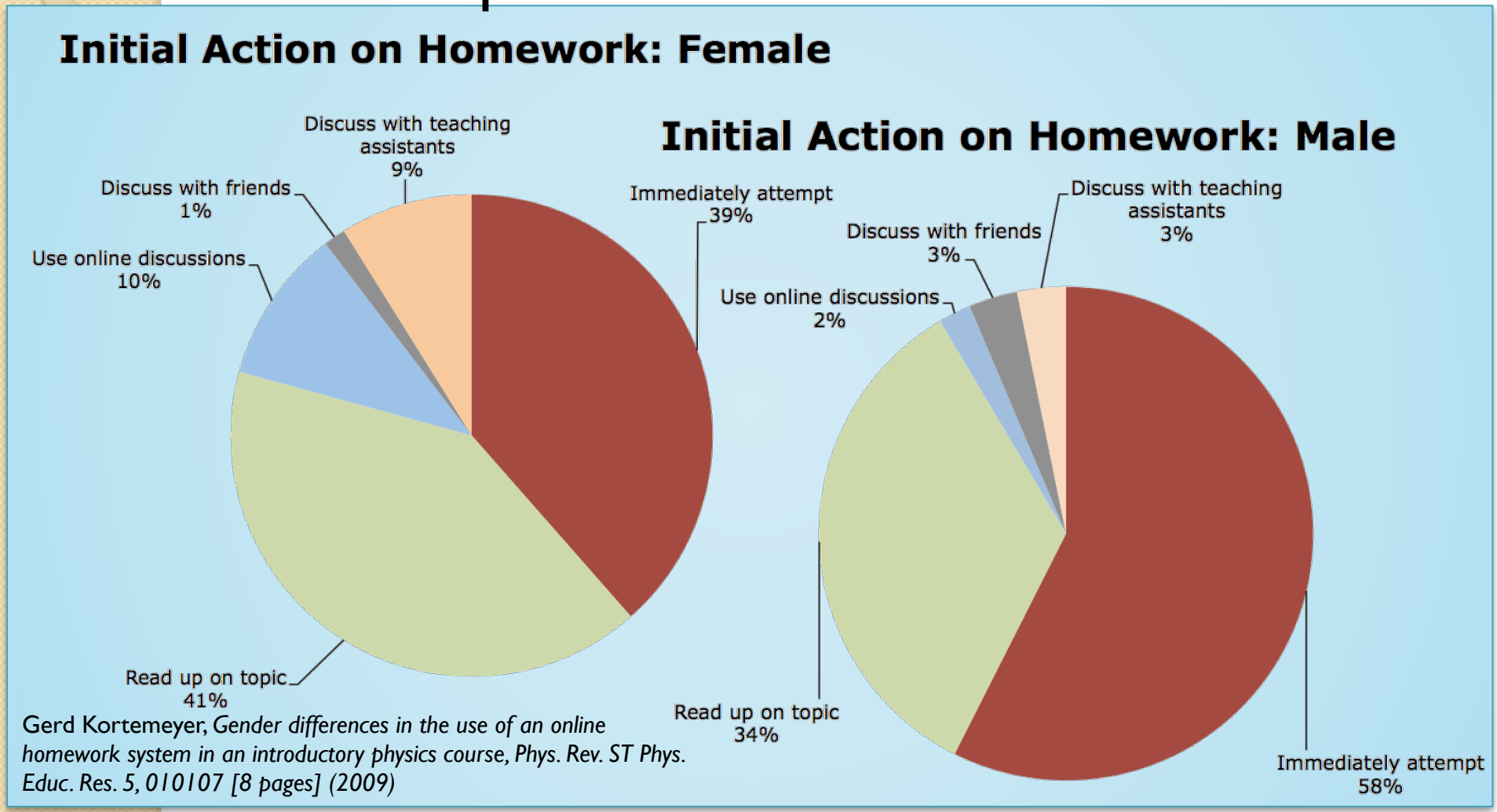
- Submitting "random" guesses to online homework
- Numerical problems





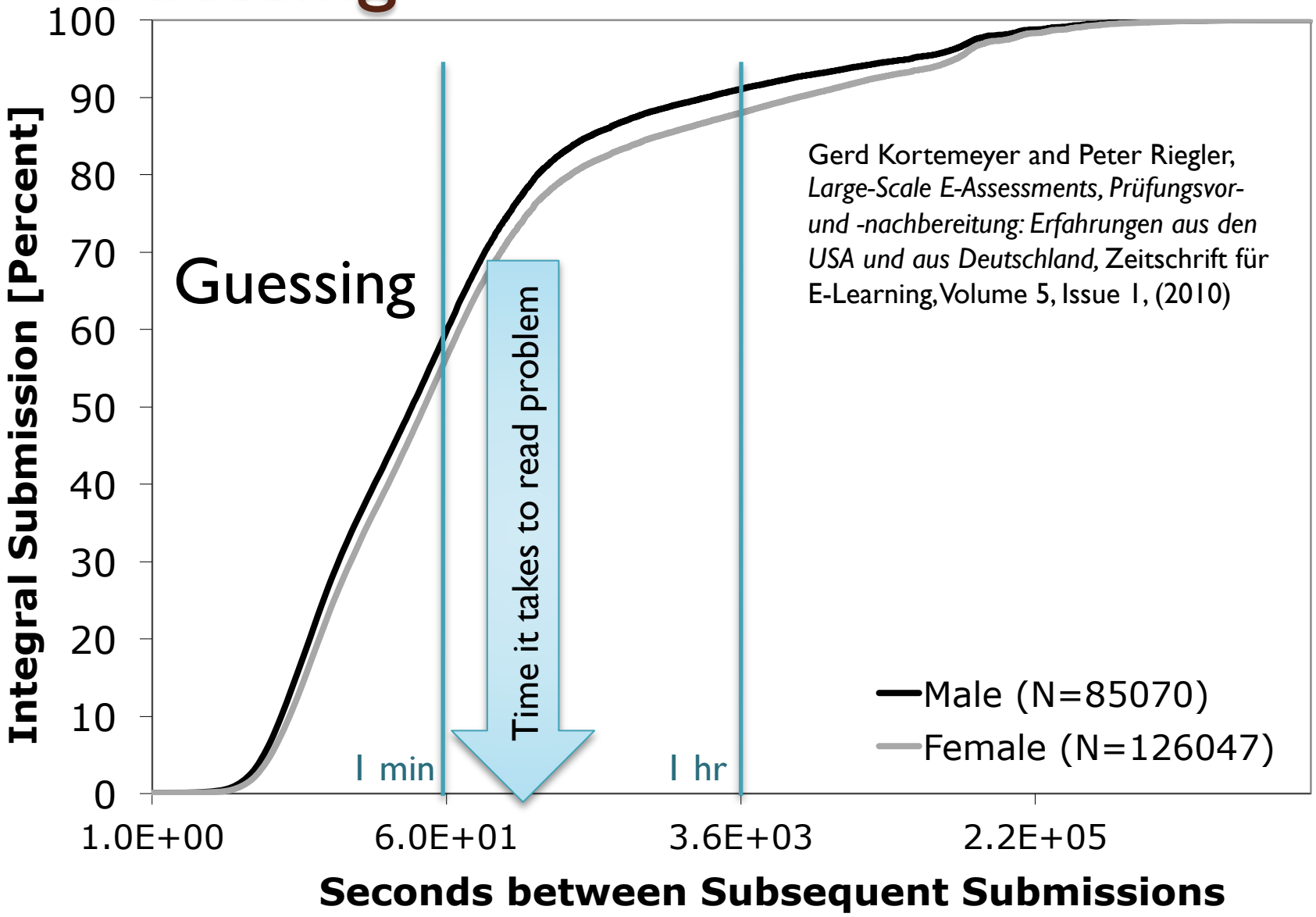
Guessing

- Self-reported: what do students do?



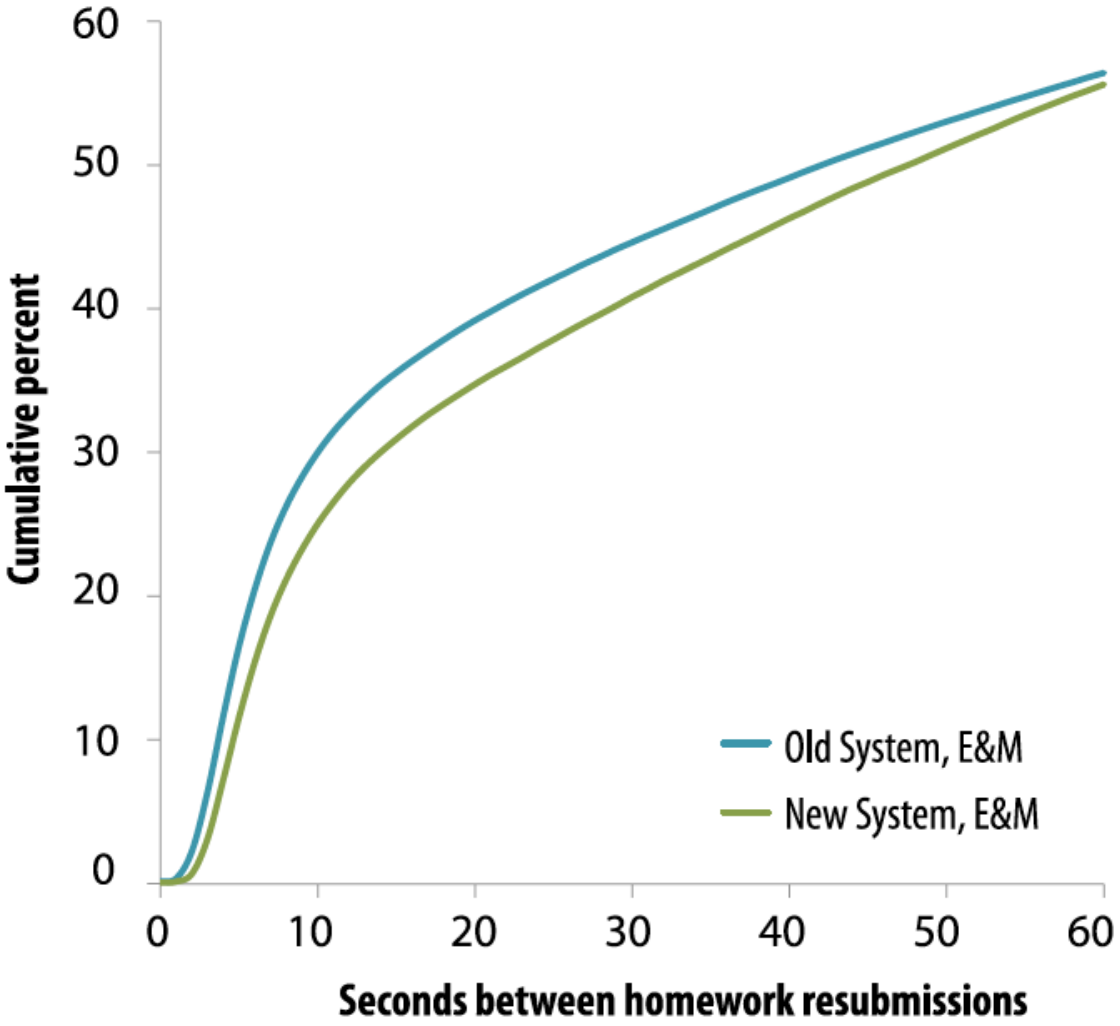
Gerd Kortemeyer, *Gender differences in the use of an online homework system in an introductory physics course, Phys. Rev. ST Phys. Educ. Res. 5, 010107 [8 pages] (2009)*

Guessing


Integral Submission [Percent]
100
90
80
70
60
50
40
30
20
10
0
Guessing
Time it takes to read problem
1 min
1 hr
1.0E+00
6.0E+01
3.6E+03
2.2E+05
Seconds between Subsequent Submissions
Male (N=85070)
Female (N=126047)
Gerd Kortemeyer and Peter Riegler, *Large-Scale E-Assessments, Prüfungsvor- und -nachbereitung: Erfahrungen aus den USA und aus Deutschland,* Zeitschrift für E-Learning, Volume 5, Issue 1, (2010)

Guessing

- More frequent exams?



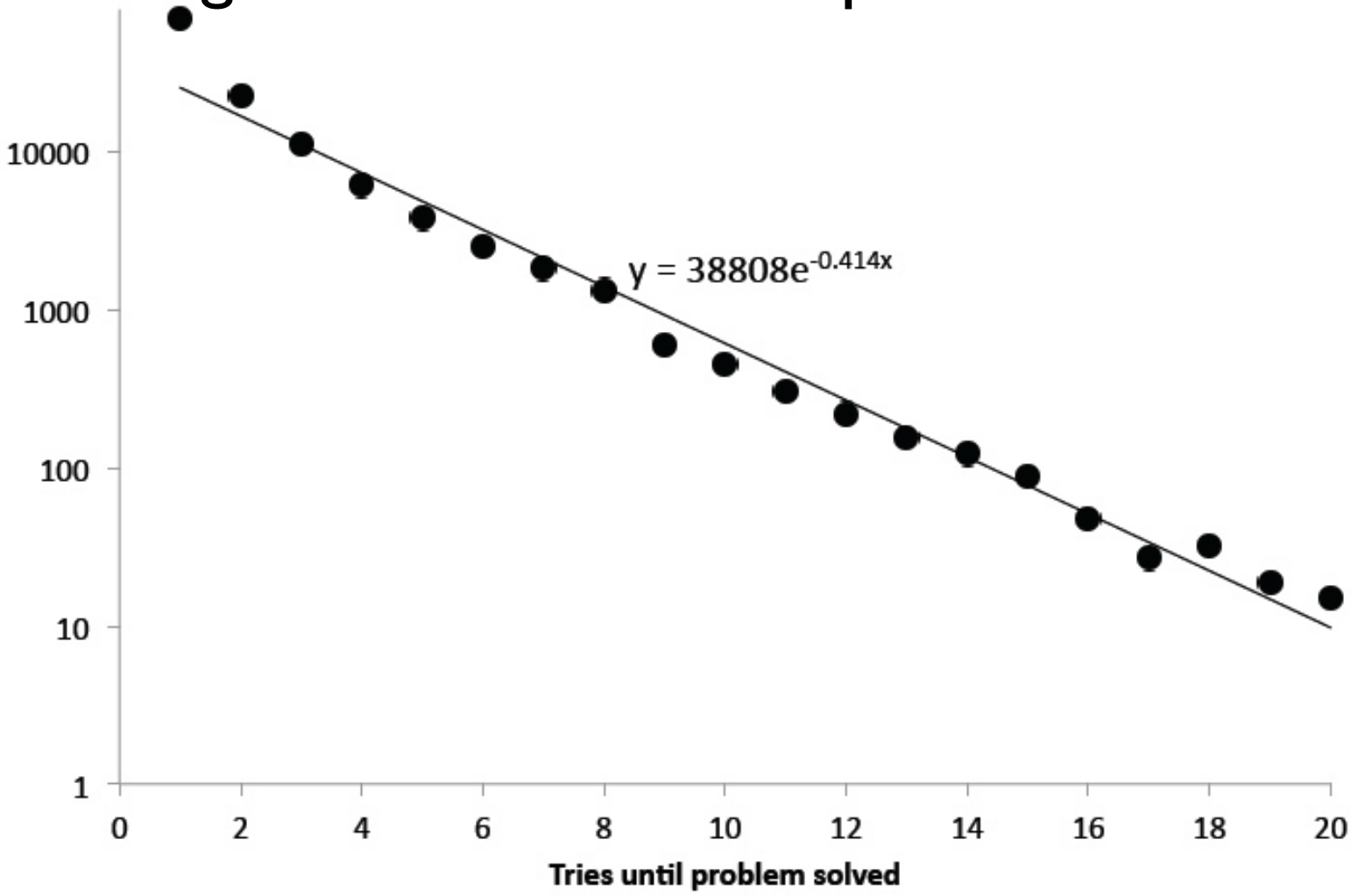
James T. Laverty, Wolfgang Bauer, Gerd Kortemeyer, and Gary Westfall, *Want to Reduce Guessing and Cheating While Making Students Happier? Give More Exams!*, The Physics Teacher **50**, 540-543 (2012)

Guessing

- Maybe just give students less tries?
- Balance:
  - Enough tries so students can succeed in this formative assessment (mastery based learning)
  - Not so many tries that they are not taken seriously

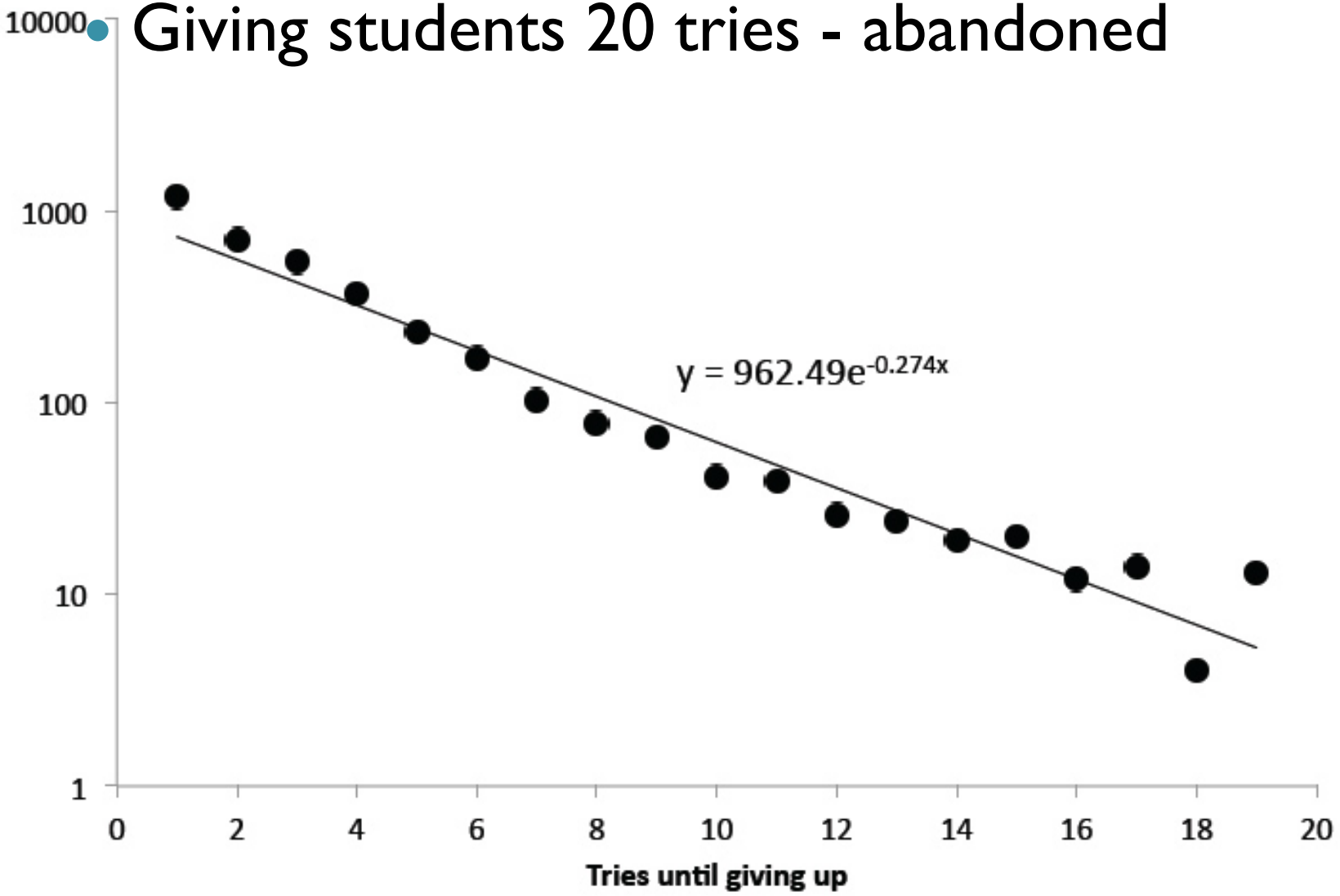
Guessing

- Giving students 20 tries – problems solved



Guessing

- Giving students 20 tries - abandoned



Guessing

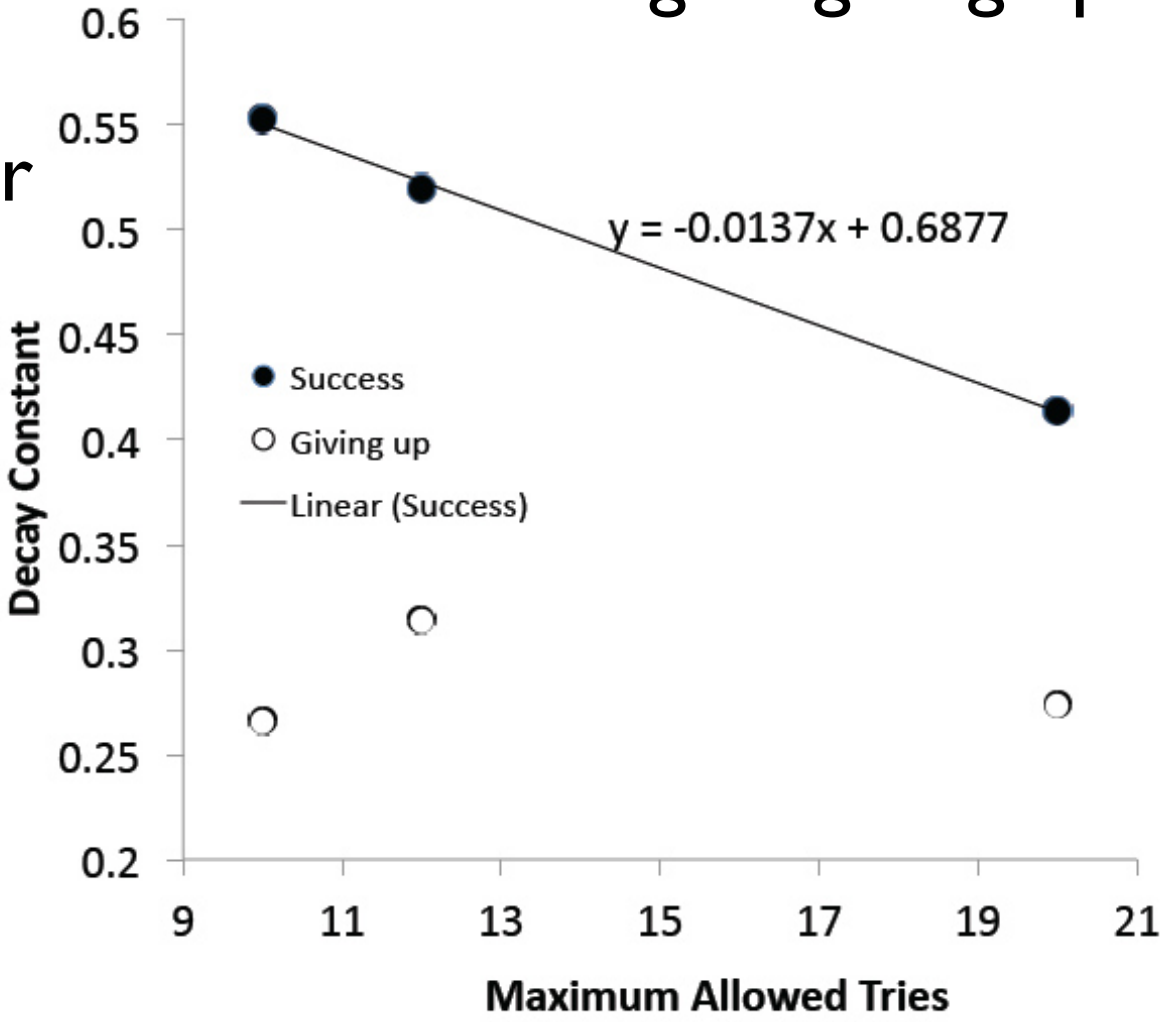
- Comparing three classes:
  10 tries, 12 tries, and 20 tries max.
- Surprisingly, for all classes, both success and giving up follow

$$\Delta N_s(n) = N_{s,0} \exp(-\lambda_s n)$$
$$\Delta N_a(n) = N_{a,0} \exp(-\lambda_a n)$$

- Tries are independent of each other!
- Lambdas are like probabilities

Guessing

- "Probabilities" of succeeding or giving up on a particular attempt



Guessing

- Students do not really profit from earlier tries
- Giving more tries reduces the probability of success on a particular try
- Also: total amount of successfully solved homework remains about the same
- Seems like 10 tries are a good idea

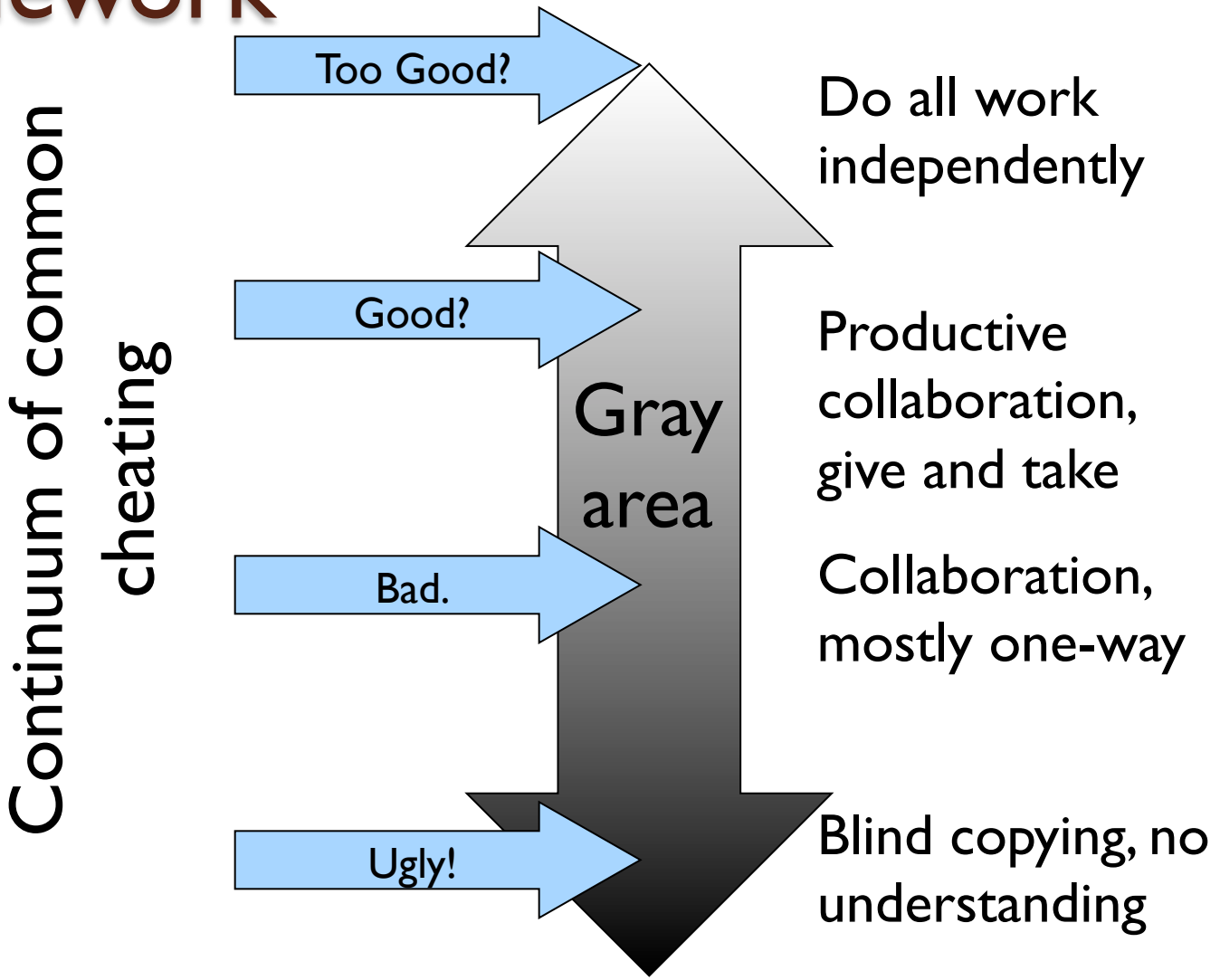
Cheating

- Now the most unpleasant unproductive behavior: cheating

Cheating

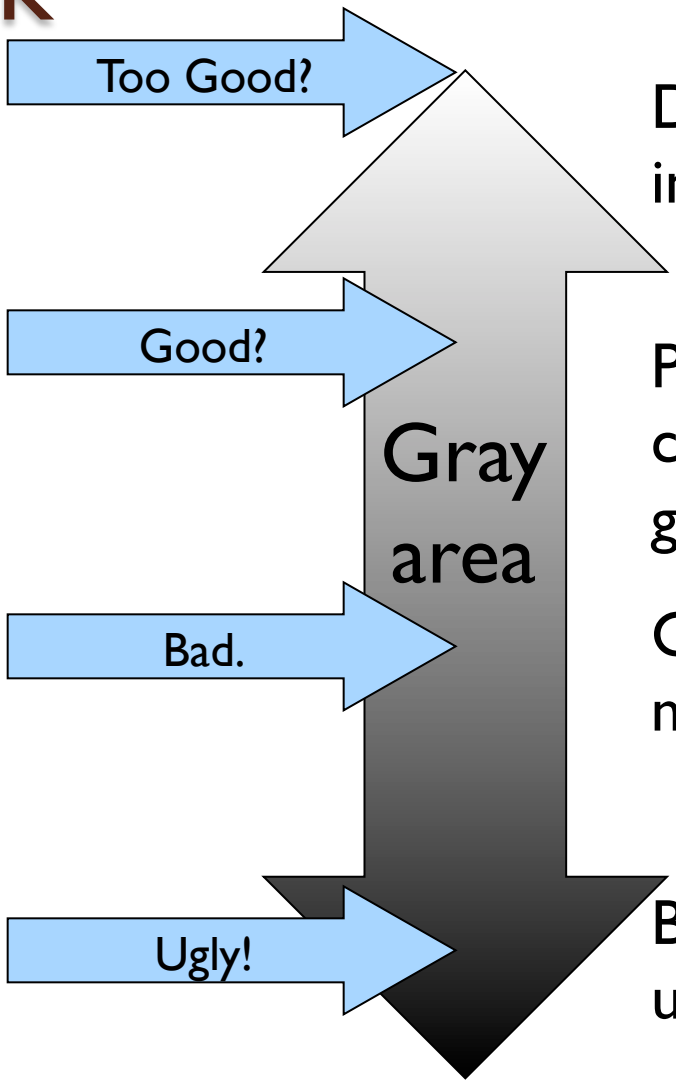
- Need to distinguish
  - Cheating on homework: leads to
    - Learning failure
    - Demoralization
  - Cheating on exams: leads to course failure
- But also:
  - Cheating has always been there
    - Unproductive collaboration increasing in general
  - What is really new in online settings?

Homework



The exceptions: Off the scale

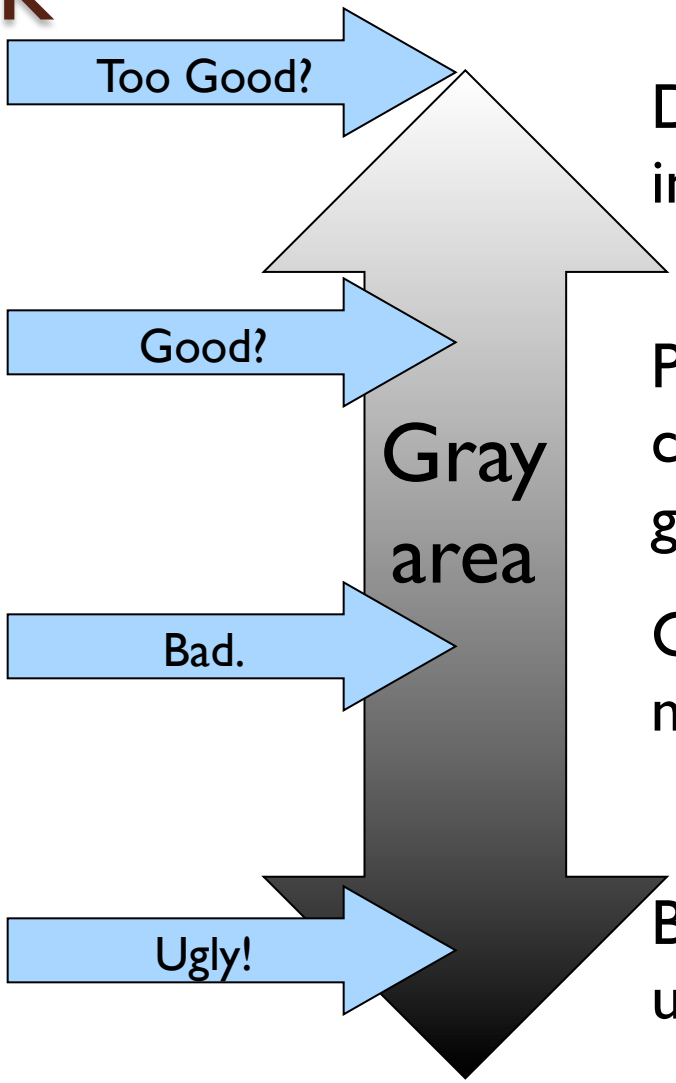
Homework



The exceptions: Off the scale

Homework

- Exceptions are very rare
- Blatant falsification of records or lying



The exceptions: Off the scale

Homework

- One class of off-the-scale cheating:
  - "The dog ate my homework"
  - Student claims to have done homework, but "the system did not register it."

Home computers are being called upon to perform many new functions, including the consumption of homework formerly eaten by the dog.

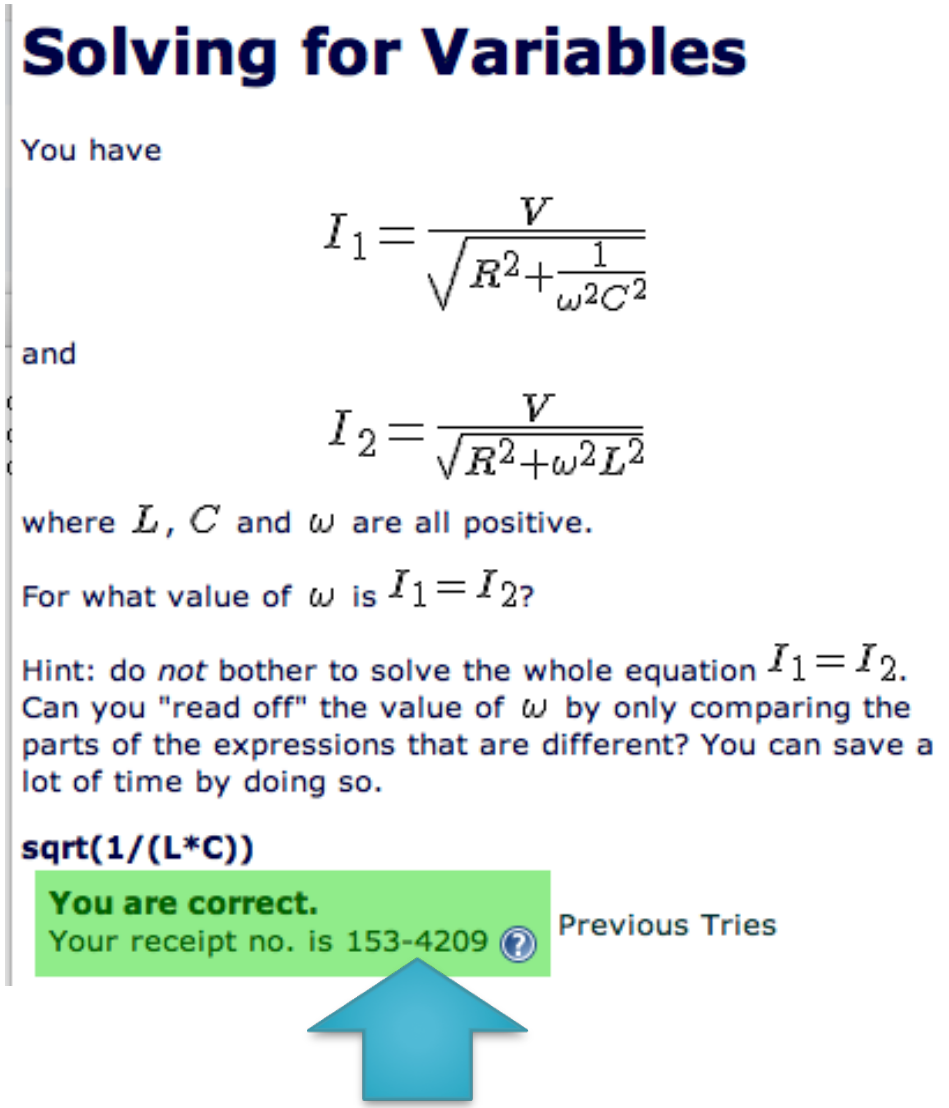
Doug Larson

Homework

- How do you prove that the student actually did **not** do the homework?
- Detailed logs:
  - Every access
  - Every submission
  - Every grading decision
  - Essentially every mouse click
- But burden of proof still on us

Homework

- Computed receipt number
  - Based on student, course, and problem instance
  - Not stored, but algorithmically determined
  - If the student had this number, it would be unique proof
- Have student write down number, do not accept any complaint without number



Solving for Variables

You have

$$I_1 = \frac{V}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}}$$

and

$$I_2 = \frac{V}{\sqrt{R^2 + \omega^2 L^2}}$$

where L, C and ω are all positive.

For what value of ω is $I_1 = I_2$?

Hint: do *not* bother to solve the whole equation $I_1 = I_2$. Can you "read off" the value of ω by only comparing the parts of the expressions that are different? You can save a lot of time by doing so.

sqrt(1/(L*C))

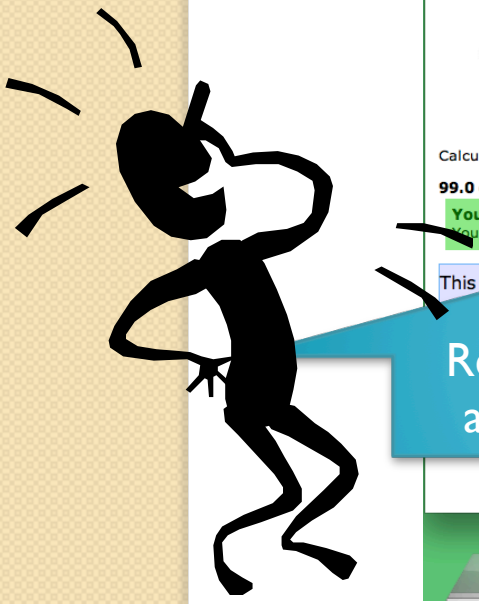
You are correct.
Your receipt no. is 153-4209

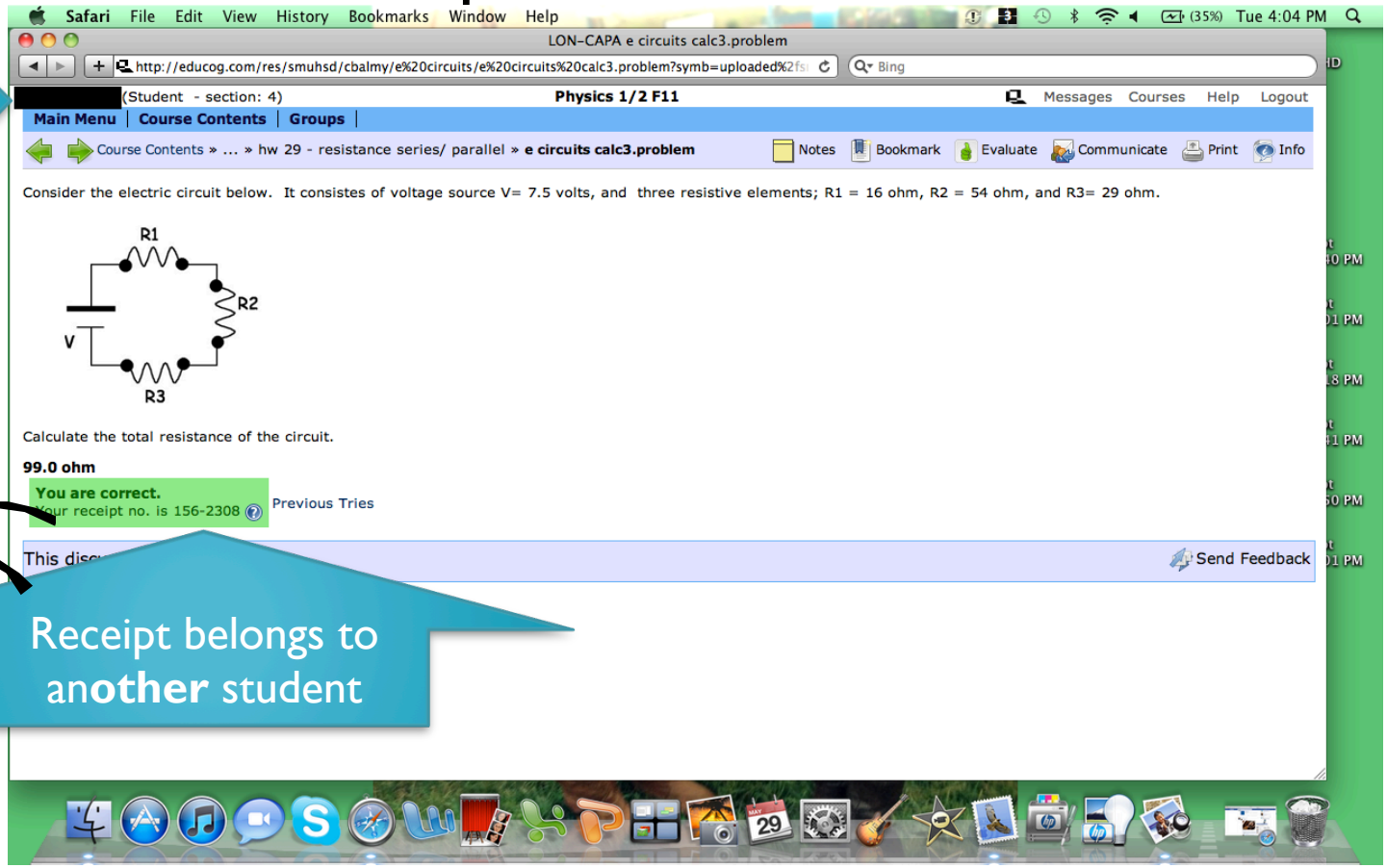
Previous Tries

Homework

- But you still might get something like this:
  - Screenshot as "proof"

Student name photoshopped





Receipt belongs to another student

Homework

- But be careful with accusations
  - What happens more often: student accidently solves homework for roommate
  - Walks up to an open session and does work
    - only it's not their own session
  - Student is genuinely confused
  - Easy to see from the logs

Homework

- Another blatant class of cheating: subscription-based cheat sites
  - pay money for subscription
  - enter random problem values in order
  - site calculates the solution

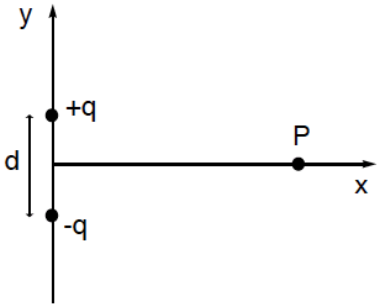
Homework

- Subscription-based cheat site
  - Randomized numbers marked in red

http://s10.lite.msu.edu/prtspool/kortemey_msu_printout_1222819074_4047_1.pdf

Gerd Kortemeyer 1

Two charges, +q and -q, are located in the x-y plane at points (0,+d/2) and (0,-d/2), respectively. Calculate the magnitude of the electric field at point P with the superposition principle.

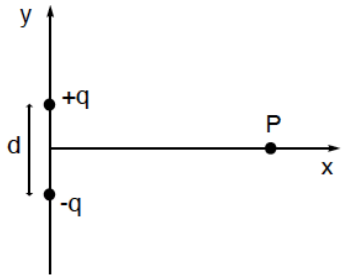


Data: q = 21.0 nC, d = 4.20 mm and P is at x = 84.0 mm.

http://www.capasolver.com/problemStatements/PDFs/em.pdf

Problem 1007: Two Separated Charges

Two charges, $+q$ and $-q$, are located in the x-y plane at points $(0, +d/2)$ and $(0, -d/2)$, respectively. Calculate the magnitude of the electric field at point P with the superposition principle, where q, d and P is at x are given quantities.

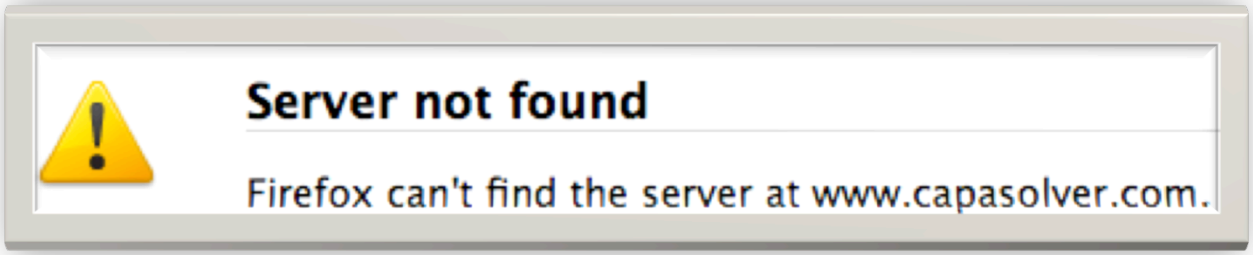


8

Anyone may obtain solutions from http://www.capaSolver.com

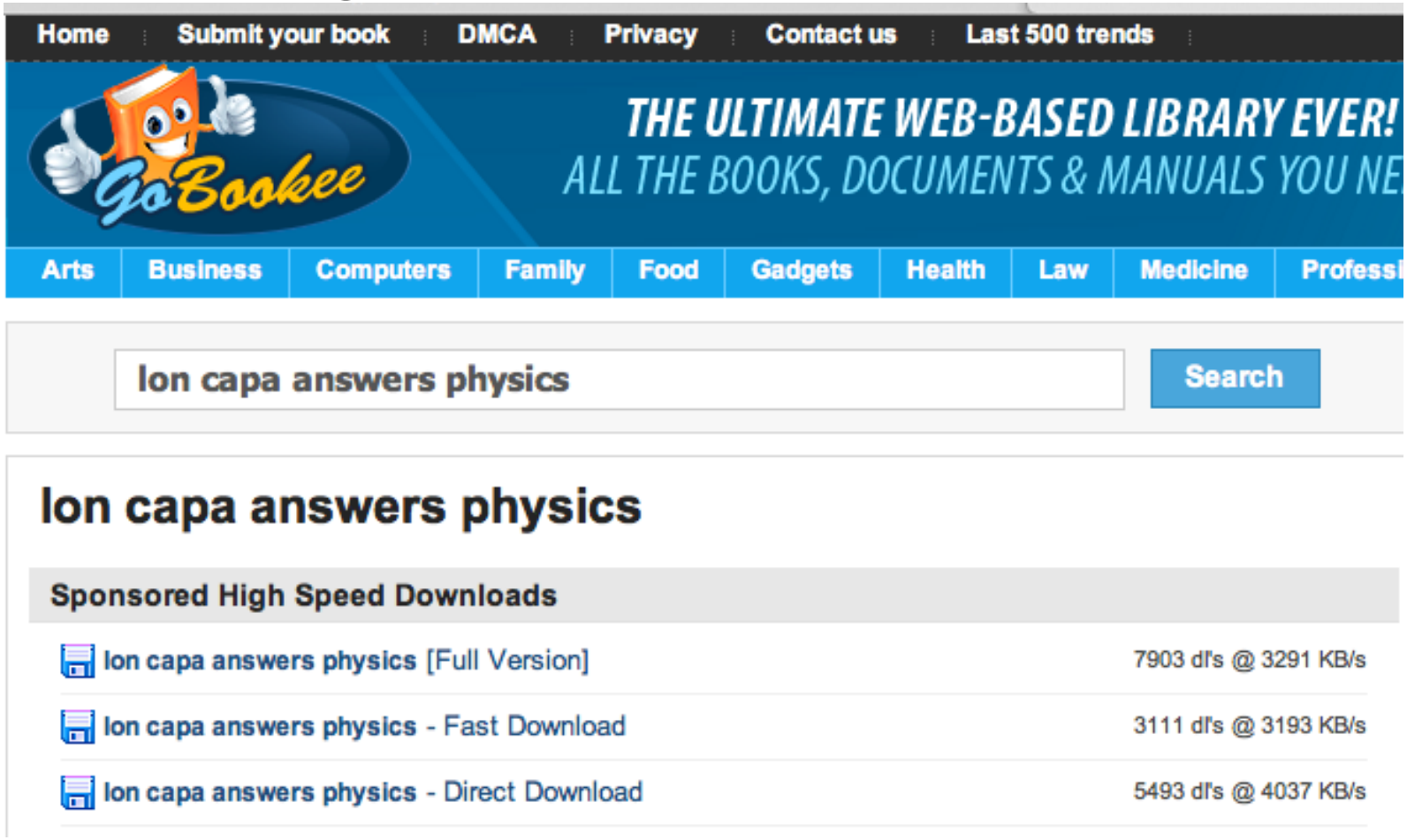
Homework

- Job for the General Counsel
- Only defense: copyright
  - Company got own copyright lawyer to claim fair use
  - No way!

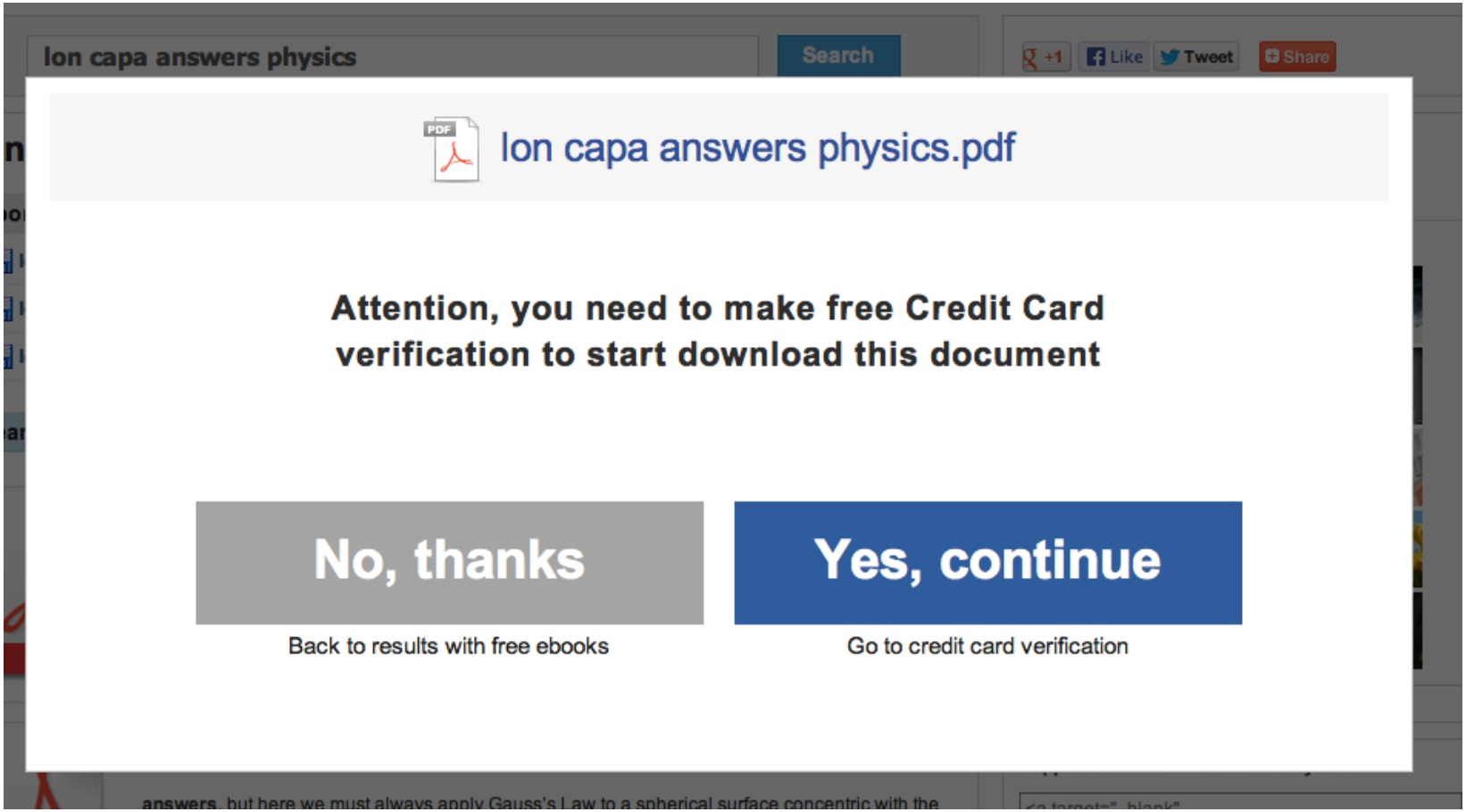


Homework

- Or this great stuff



Homework



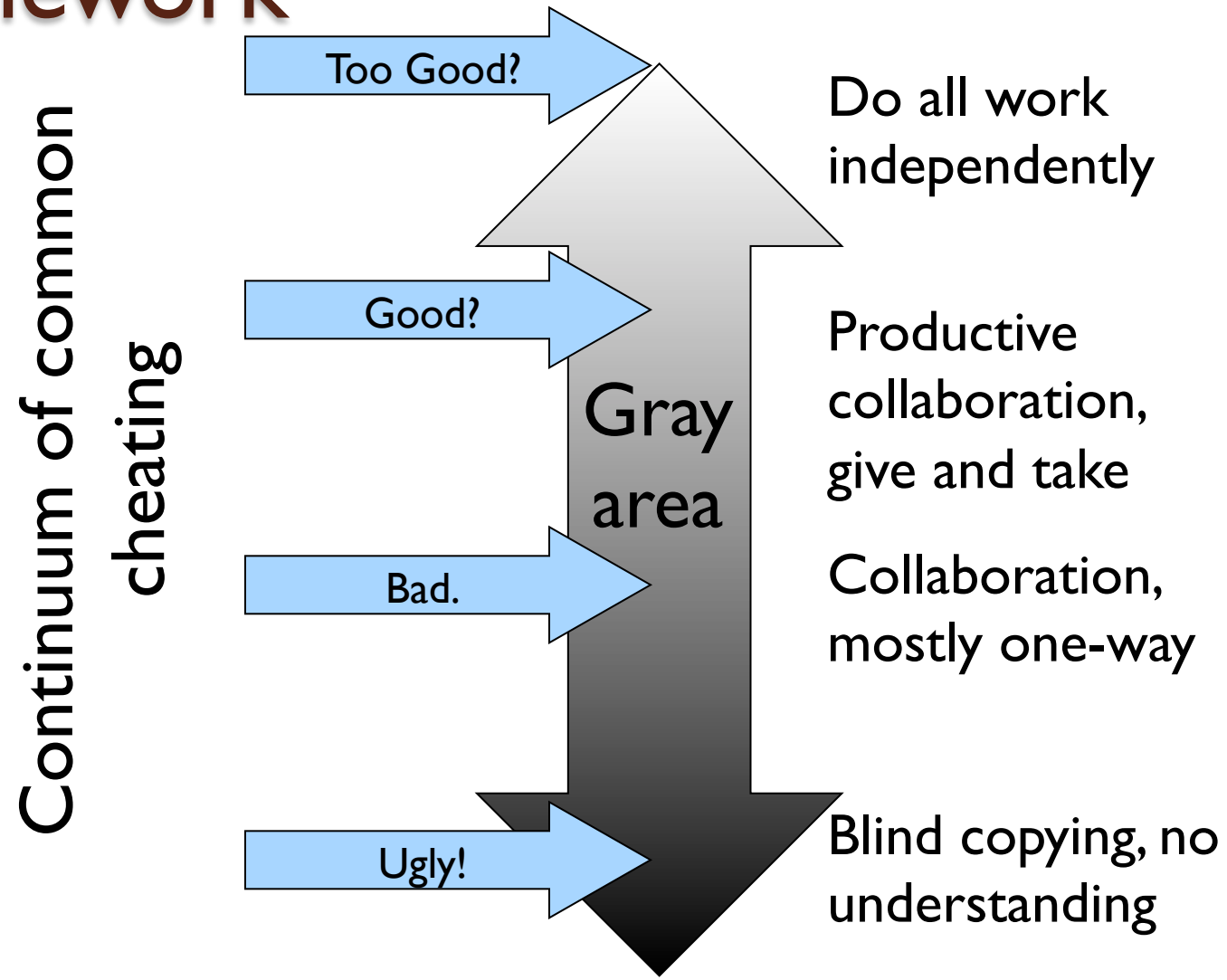
- Yeah, right.

Homework

- But this kind of blatant cheating is the exception!!!
- Do not worry about this so much
- Much more common is unproductive behavior on the "continuum of cheating"

Homework

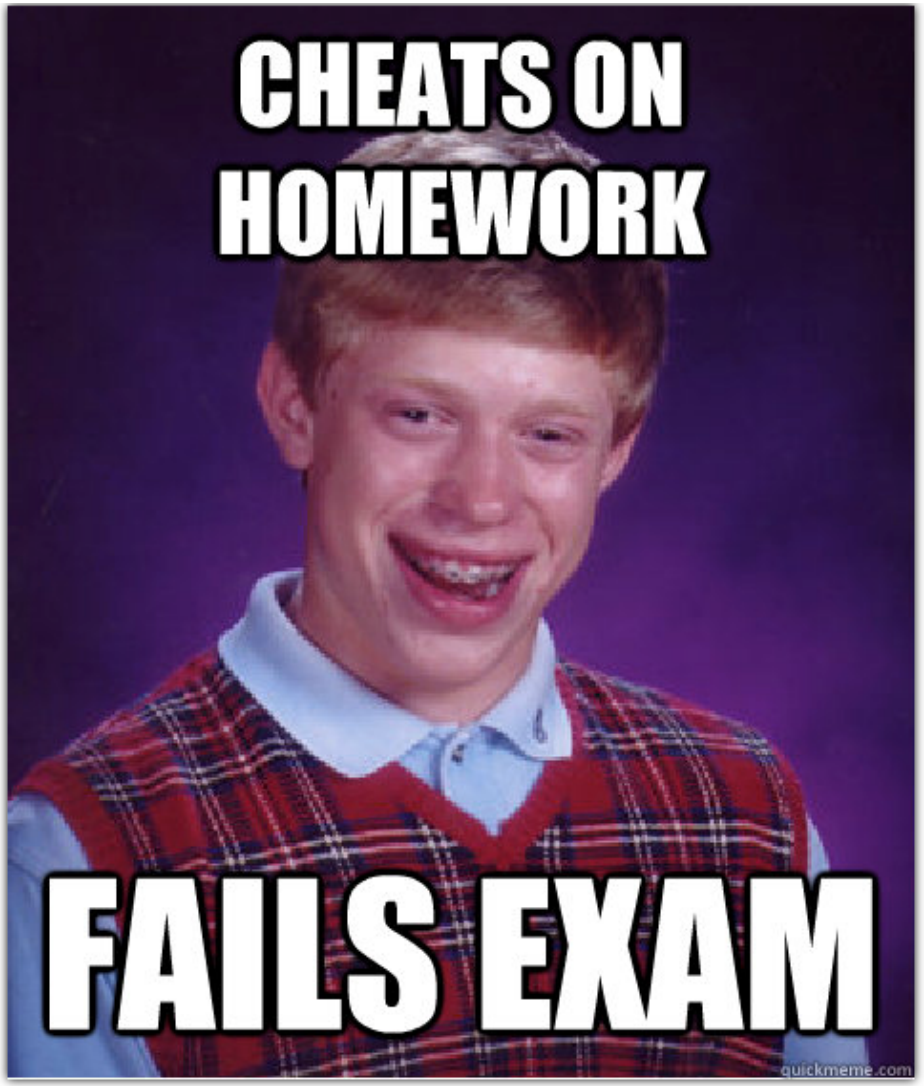
Let's look at these



The exceptions: Off the scale

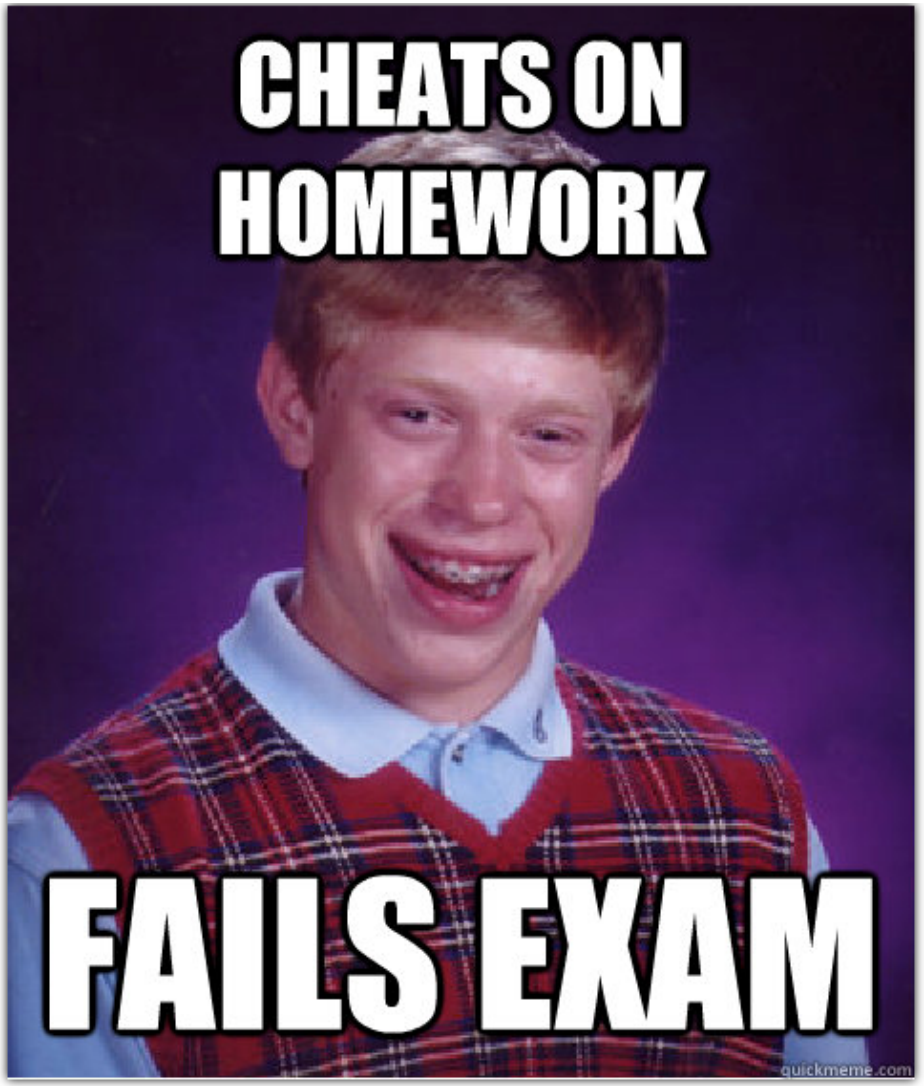
Homework

- First reaction: simplistic view, just do nothing



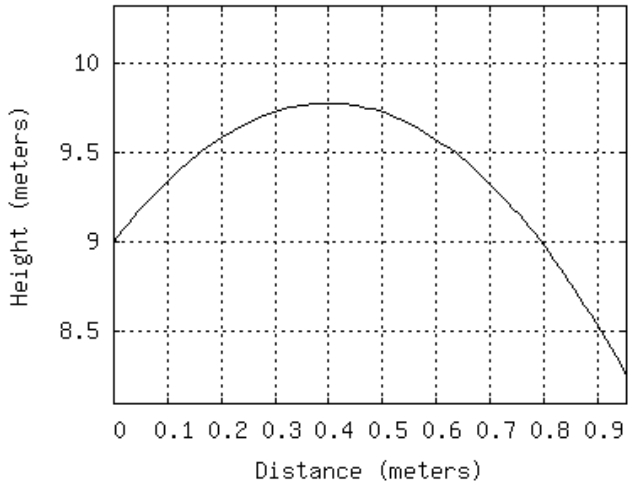
Homework

- But is this even true?
- Study at MSU: sanctioned versus non-sanctioned discussion forums



Kashy, D.A., Albertelli, G., Bauer, W., Kashy, E., Thoennessen, T., *Influence Of Non-Moderated And Moderated Discussion Sites On Student Success*, Journal of Asynchronous Learning Networks, Vol.7, No. 1 (2003)

Homework



The plot shows the trajectory (height versus distance) of an object launched at an angle of 75.6 degrees. What was the initial speed of the object? **4.0 m/s**
Computer's answer now shown above. Tries 0/12

Threaded View Chronological View Sorting/Filtering options Export?

Anonymous 1 (Fri Sep 22 01:26:29 2006 (EDT))

any hints to start?

Re: *Anonymous 2* (Fri Sep 22 01:56:48 2006 (EDT))

You need to find the Y component of velocity... you can do this by finding the height traveled (notice it does not start on the ground) and combining that with acceleration in a kinematics equation. From there use trig to get the original velocity.

Re: Re: *Anonymous 1* (Fri Sep 22 12:10:37 2006 (EDT))

how can we find the height traveled and how can we get the acceleration if we don't have the time?

Anonymous 3 (Fri Sep 22 16:41:27 2006 (EDT))

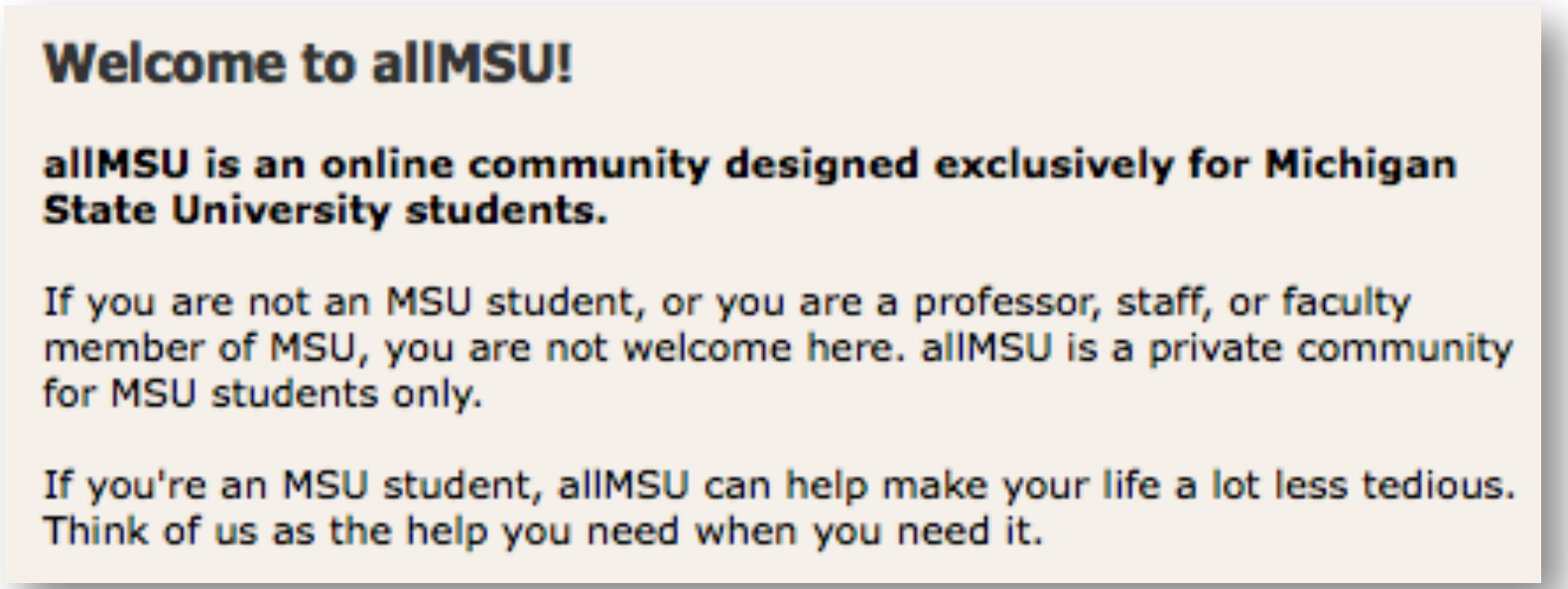
i'm lost on this one... can anyone help?

Re: *Anonymous 4* (Fri Sep 22 20:02:45 2006 (EDT))

Use the squared kinematics equation - so Vf^2 = Vi^2 + 2a (Xf-Xi).

Sanctioned Discussions
Encouraged, since all students have different versions.
Feedback and peer-instruction.

Homework



Welcome to allMSU!

allMSU is an online community designed exclusively for Michigan State University students.

If you are not an MSU student, or you are a professor, staff, or faculty member of MSU, you are not welcome here. allMSU is a private community for MSU students only.

If you're an MSU student, allMSU can help make your life a lot less tedious. Think of us as the help you need when you need it.

Unsanctioned Discussions

Professors not welcome

Homework

- The course had sanctioned discussion site (with instructors present) and 3rd-party "cheat" site
  - For usage of non-sanctioned site, relied on student self-reporting
  - For usage of sanctioned site, data was available about "looking" and "posting"
- Result: 3rd party: bad; Sanctioned: good

Correlation coefficients and p-values

	3rd Party Percent	Post-sanctioned	Look-sanctioned
Homework	0.041 (0.655)	0.118 (0.016)	-0.109 (0.026)
Final Exam	-0.348 (0.001)	0.147 (0.003)	0.129 (0.008)
Midterm Exams	-0.352 (0.001)	0.166 (0.001)	0.160 (0.001)
Quizzes	-0.302 (0.001)	0.098 (0.044)	0.069 (0.157)
FCI Improvement	-0.151 (0.162)	0.121 (0.034)	0.152 (0.008)

Homework

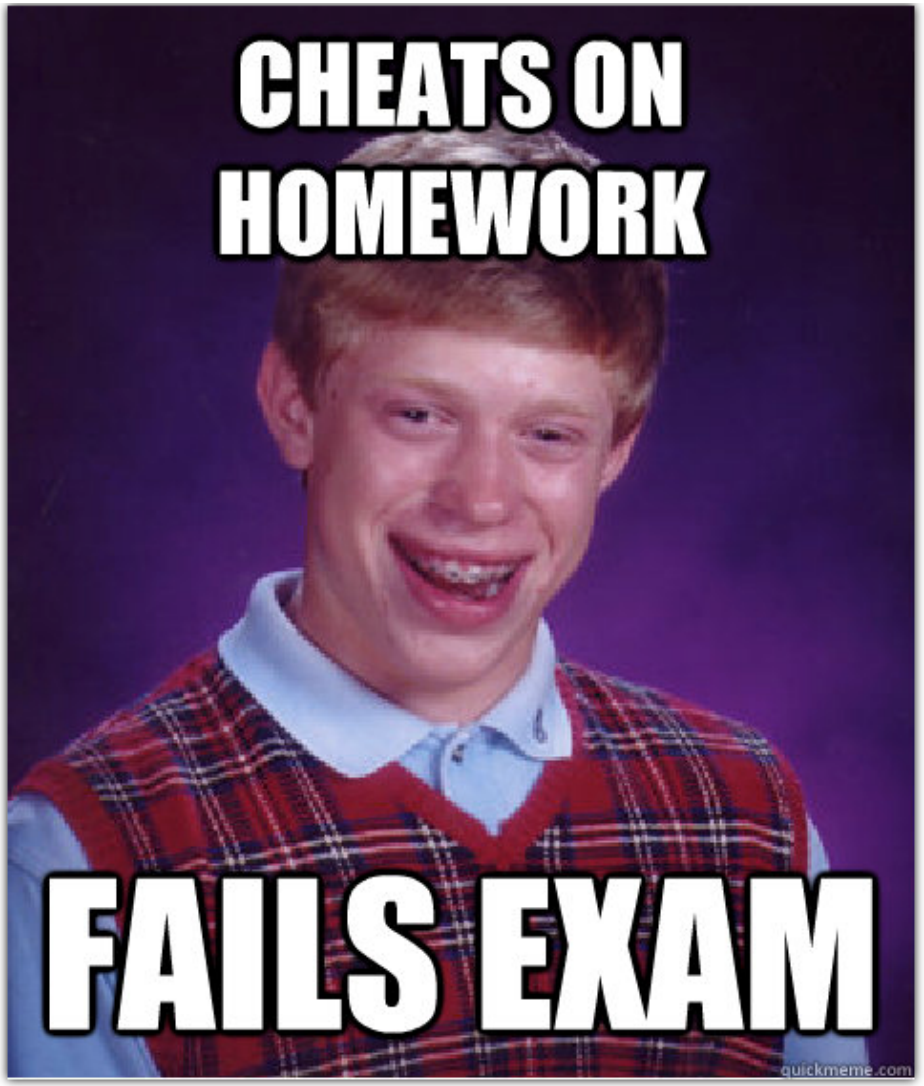
- Just the not-so-academically inclined students?
- Effect controlled for ACT scores
- Still: significant negative correlation with Midterm and Final exams.

Correlation coefficients and p-values

	3rd Party Percent	Post-sanctioned	Look-sanctioned
Homework	.024(.804)	.121(.018)	-.115(.024)
Final Exam	-.327(.001)	.126(.014)	.098(.056)
Midterm Exams	-.314(.001)	.116(.023)	.111(.030)
Quizzes	-.247(.009)	.045(.376)	.023(.654)
FCI Improvement	-.149(.192)	.081(.172)	.115(053)

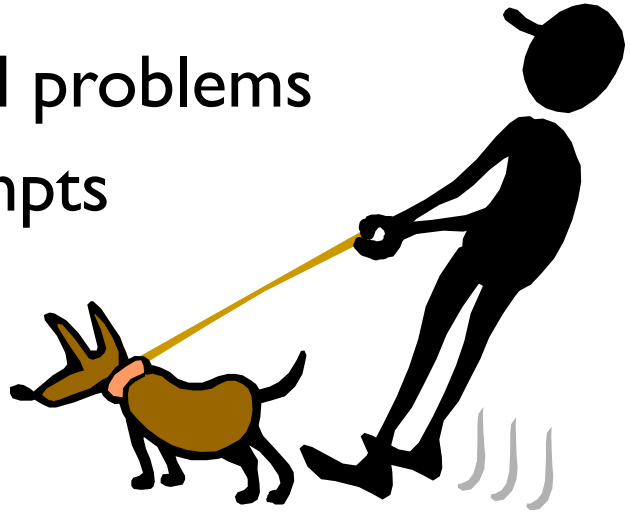
Homework

- So, yes, it's true, mostly
- But apart from "revenge" and "higher justice"
  - not really doing the students a service
  - frustrating to honest students
  - course morale suffers



Homework

- Second reaction: Let's hunt them down!
- Should be easy, since we have a lot of data:
  - Access times of pages and problems
  - Submission times of attempts
  - Entered answers
  - Online discussions



Homework

- So: find signature patterns of cheating

Homework

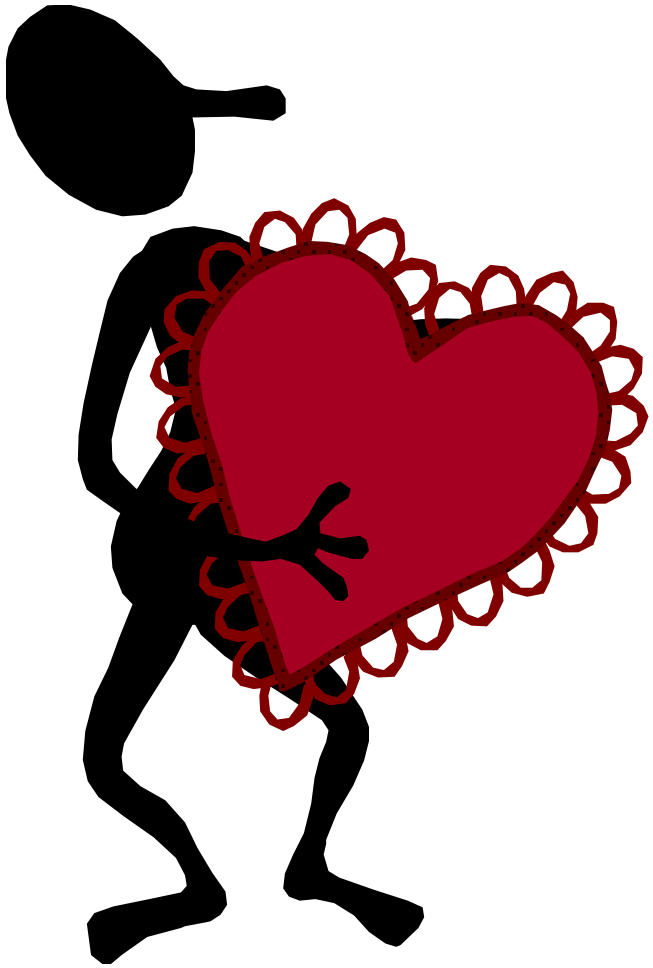
- In reality this is very hard
- Yes, there is a lot of data, but also a lot of noise:
  - Navigational events
  - Guessing
  - Working with printouts
  - Genuine collaborations
  - etc.
- One can do a lot of good statistics, but in the end one ends up with probabilities and confidence intervals

Homework

- Too cumbersome: if you find a signature event, what can you actually prove?
  - Good for research, not for "law enforcement"
- And: do you really want to police your course? What does *that* do to morale?

Homework

- Third reaction: let's be proactive instead of reactive!



Homework

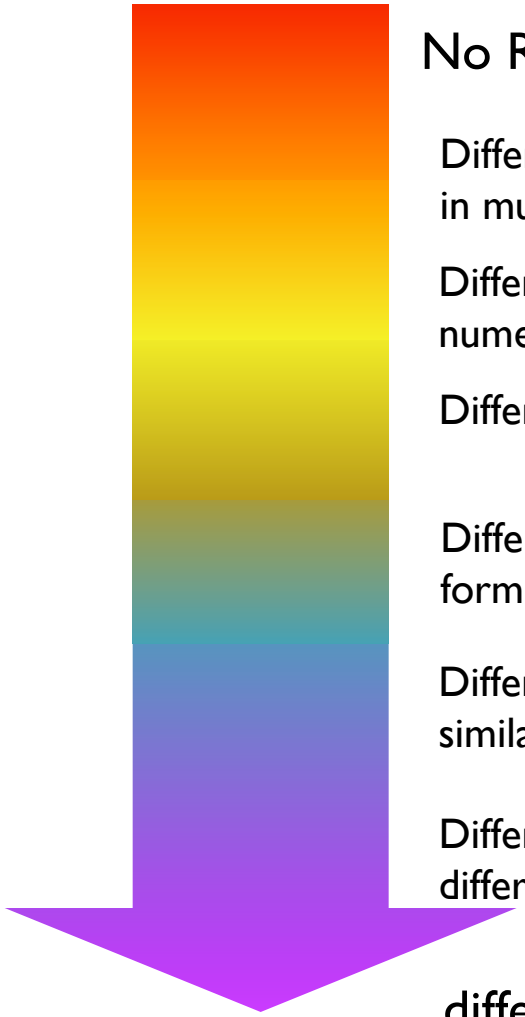
- Reaction 3.1:
  Tell them how bad cheating is
- Gave students paper with results on 3rd-party "cheating" site and correlated exam performance
  - Did not tell them about the difference between correlation and causation
- What do you think happened?

Homework

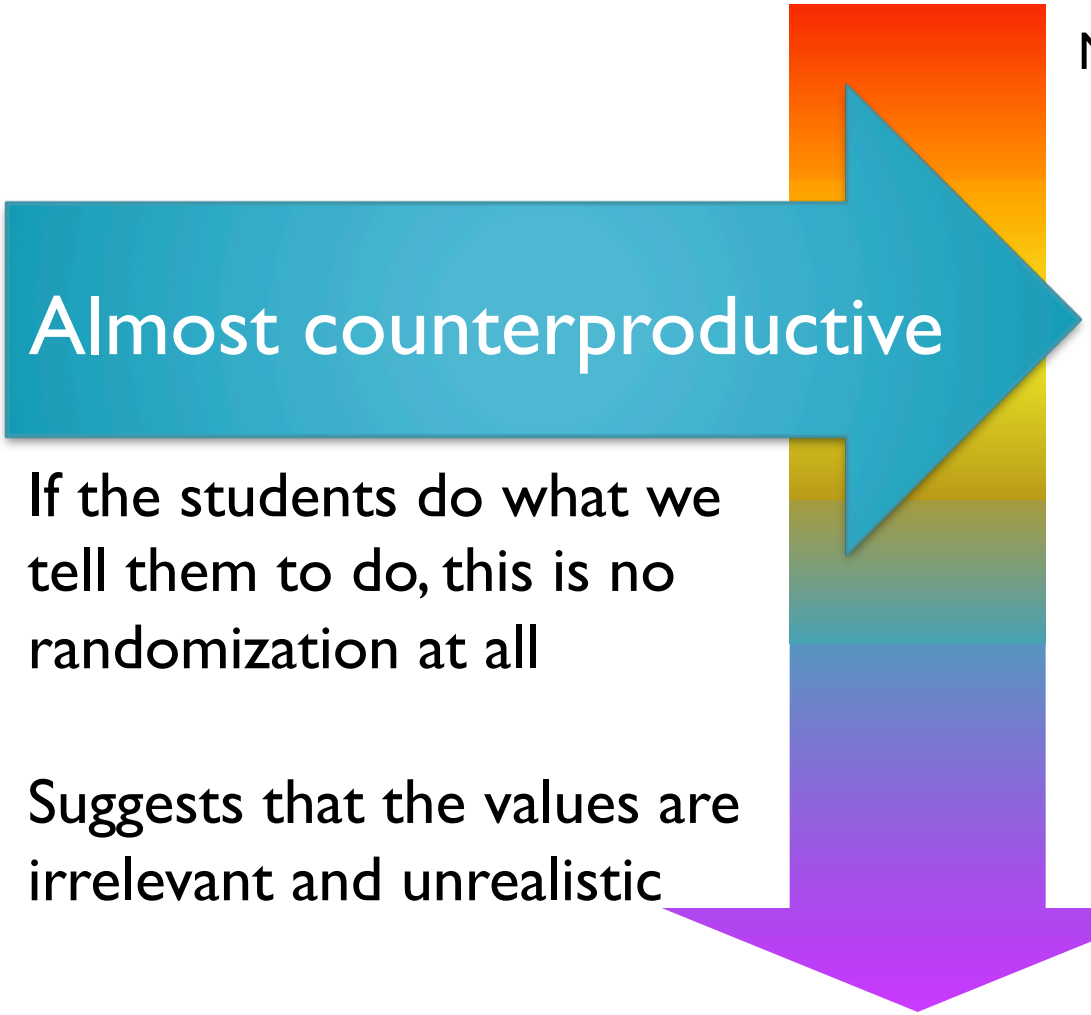
- Self-reported use of the 3rd-party site **increased**
  - Risk was now calculable
- Backfired!

Homework

- Reaction 3.2: randomizing problems
- Making doing the homework easier than copying it



Homework

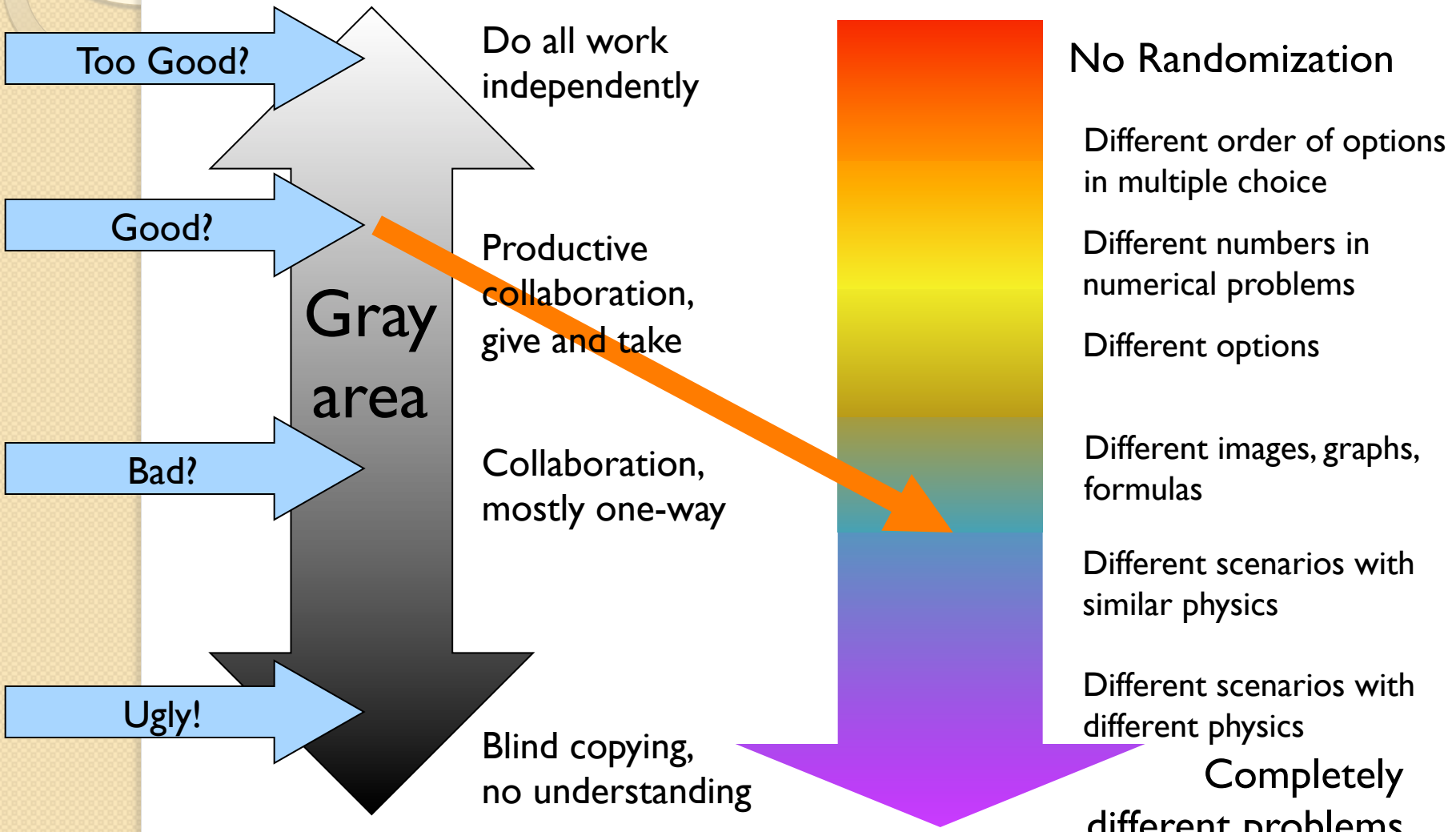


Almost counterproductive

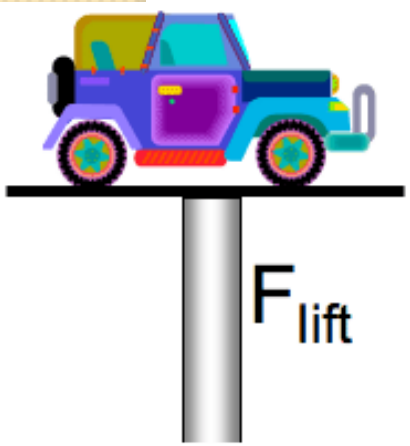
If the students do what we tell them to do, this is no randomization at all

Suggests that the values are irrelevant and unrealistic

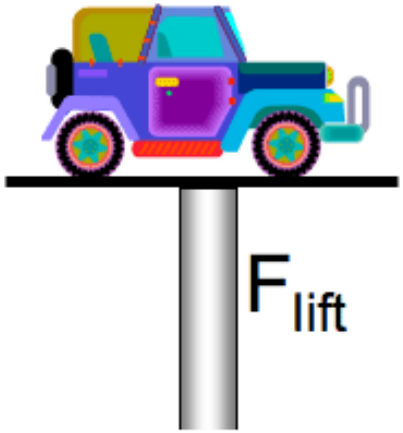
Homework


Too Good?
Good?
Bad?
Ugly!
Gray area
Do all work independently
Productive collaboration, give and take
Collaboration, mostly one-way
Blind copying, no understanding
No Randomization
Different order of options in multiple choice
Different numbers in numerical problems
Different options
Different images, graphs, formulas
Different scenarios with similar physics
Different scenarios with different physics
Completely different problems

Homework



A car (mass of 750
sitting on a car lift in a shop (neglect th
of the lift itself). While the car is being l
up, it is speeding up with 2.3 m/s^2. Wha
the magnitude of the lifting force?



A car (mass of 990 kg) is sitting on a car lift in a shop (neglect the mass of the lift itself). While the car is being lowered, it is speeding up with 3.3 m/s^2. What is the magnitude of the lifting force?

A car (mass of 940 kg) is
a car lift in a shop (neglect the mass of the lift itself). While the car is being lifted up, it is slowing down with 2.1 m/s^2. What is the magnitude of the lifting force?

Lifting/lowering,
speeding up/slowing down,
different numbers

Homework

A plate capacitor has been charged. Its plates are then pushed closer together after they had been disconnected from the voltage source.

- The capacitance increases.
- The capacitance stays the same.
- The capacitance decreases.

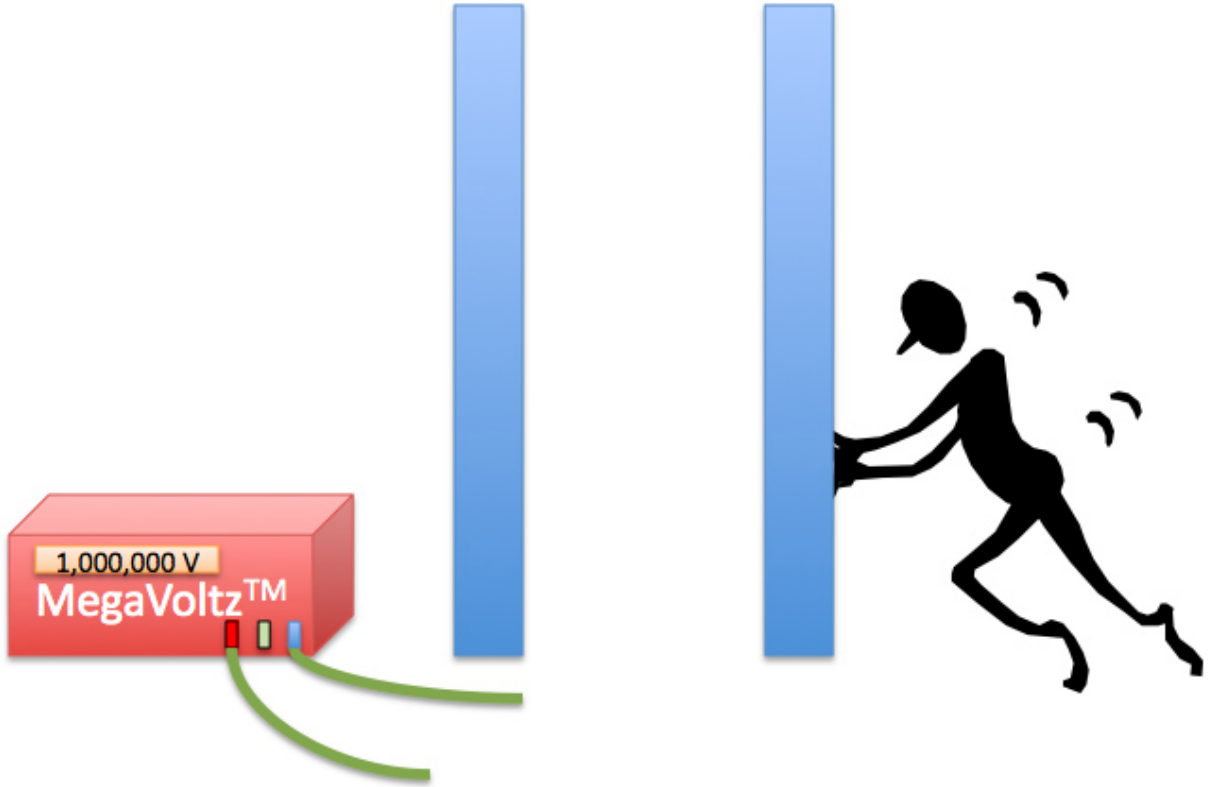
Submit Answer Tries 0

- The voltage increases.
- The voltage stays the same.
- The voltage decreases.

Submit Answer Tries 0

- The charge increases.
- The charge stays the same.
- The charge decreases.

Submit Answer Tries 0



Homework

A plate capacitor has been charged. Its plates are then pulled further apart while still connected to the voltage source.

- The capacitance increases.
- The capacitance stays the same.
- The capacitance decreases.

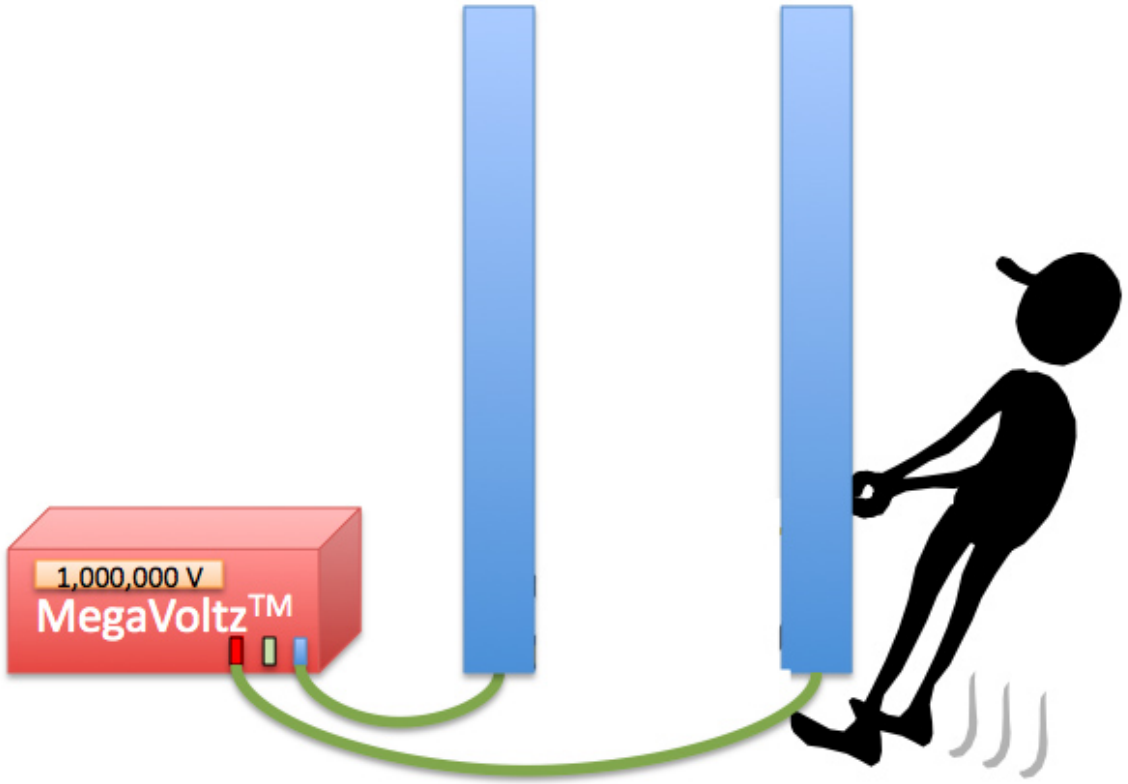
Submit Answer Tries 0

- The voltage increases.
- The voltage stays the same.
- The voltage decreases.

Submit Answer Tries 0

- The charge increases.
- The charge stays the same.
- The charge decreases.

Submit Answer Tries 0



Homework

Two ways how the paper could slide off the fridge:

•Magnet slides off paper
•Paper and magnet
slide off fridge

Depending on values, one or the other decides.

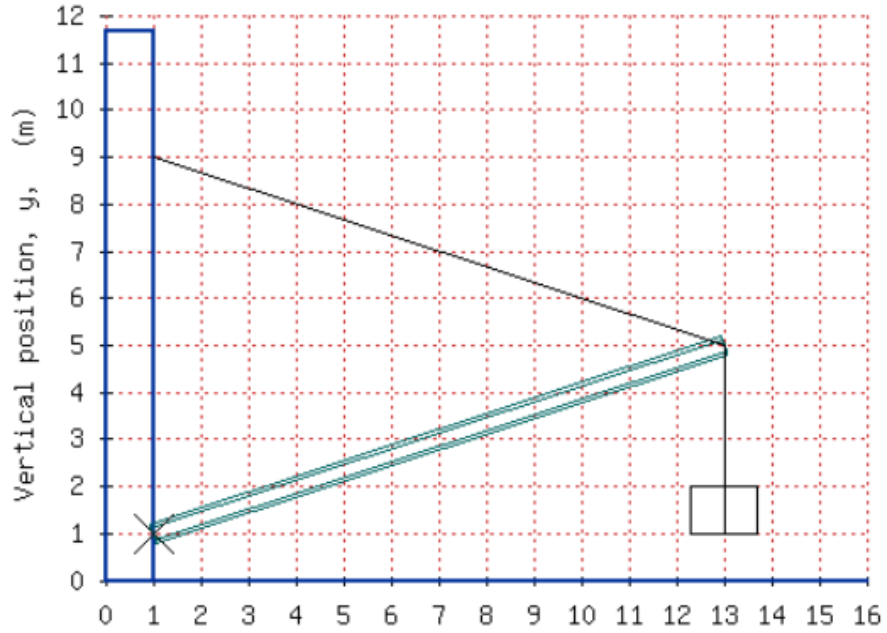
A sheet of paper is attached to the door of your refrigerator by a magnet. The coefficient of static friction between the fridge door and the paper is 0.6, and between the paper and the magnet is 1.4. The mass of the paper is 2 gram, the mass of the magnet is 10 gram. What is the magnitude of the minimum force with which the magnet must be attracted to the fridge, so the note sticks?

Submit Answer Tries 0

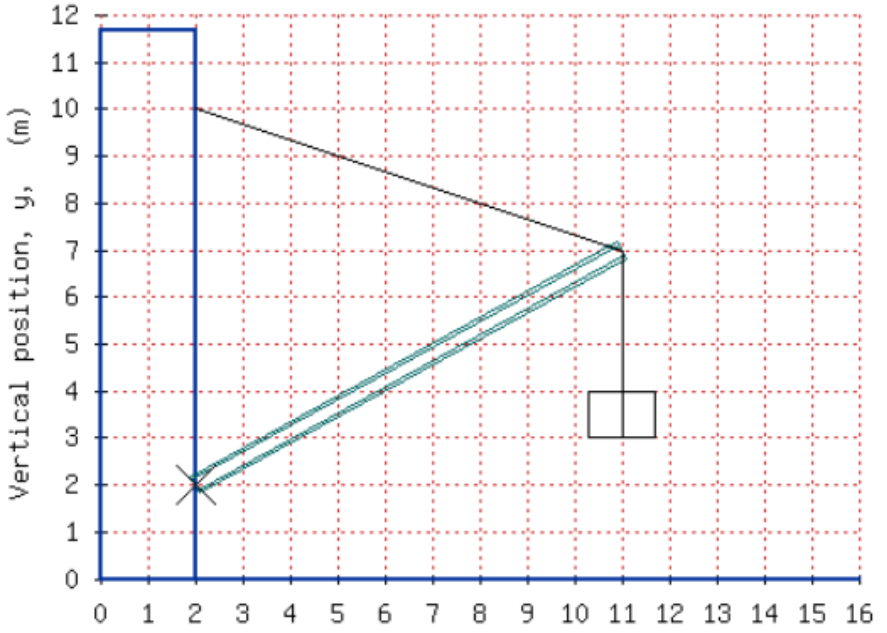
Homework

- One problem, sample of two versions

A crate with a mass of 155.5 kg is suspended from the end of a uniform boom with mass of 89.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.

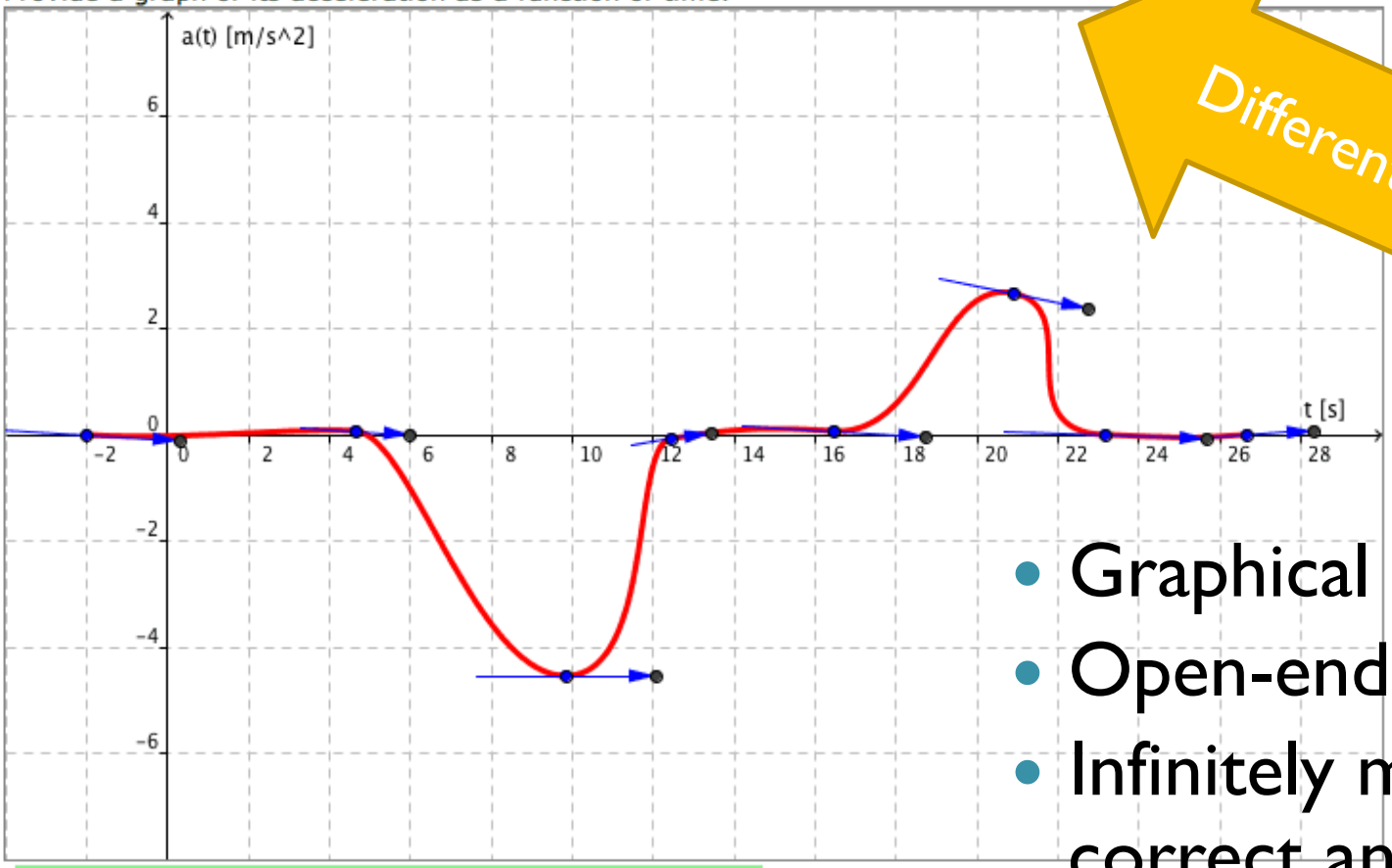


A crate with a mass of 177.5 kg is suspended from the end of a uniform boom with mass of 88.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



Homework

At t=0 s, a car cruises at a constant positive velocity. Suddenly, a light switches to red. At t=10 s, the driver is maximum on the brake. The car then stops in front of the red light for over 2 seconds. Eventually, it drives off, and then again cruises at a constant velocity. The car cannot accelerate with more than 3 m/s^2.
Provide a graph of its acceleration as a function of time.



Different stories

- Graphical input
- Open-ended
- Infinitely many correct answers

You are correct. Computer's answer now shown above. Previous Tries

Script Vars
Rules Log

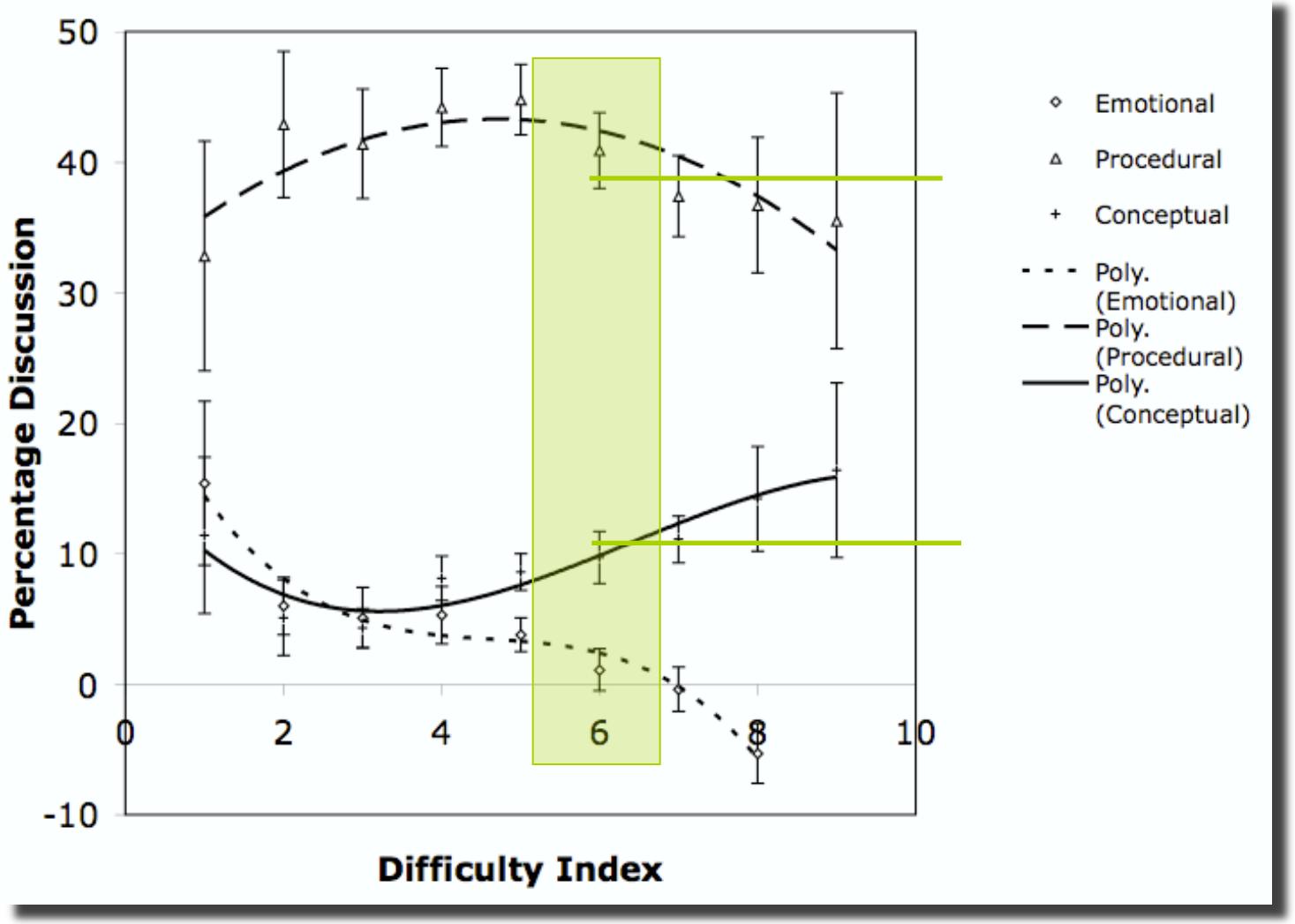
Homework

Based on analysis of student discussions

- Reducing copying: don't use simple problem types
  - Multiple Choice:
    - highest percentage of solution-oriented discussions ("that one is right")
    - least number of physics discussions
  - Ranking and click-on-image problems:
    - Physics discussions highest
  - Problems with representation-translation (reading a graph, etc):
    - slightly less procedural discussions
    - more negative emotional discussion (complaints)
- Use mid-range difficulty problems

Homework

- Reducing copying: mid-range difficulty
- Above mid-range: more pain, no (significant) gain

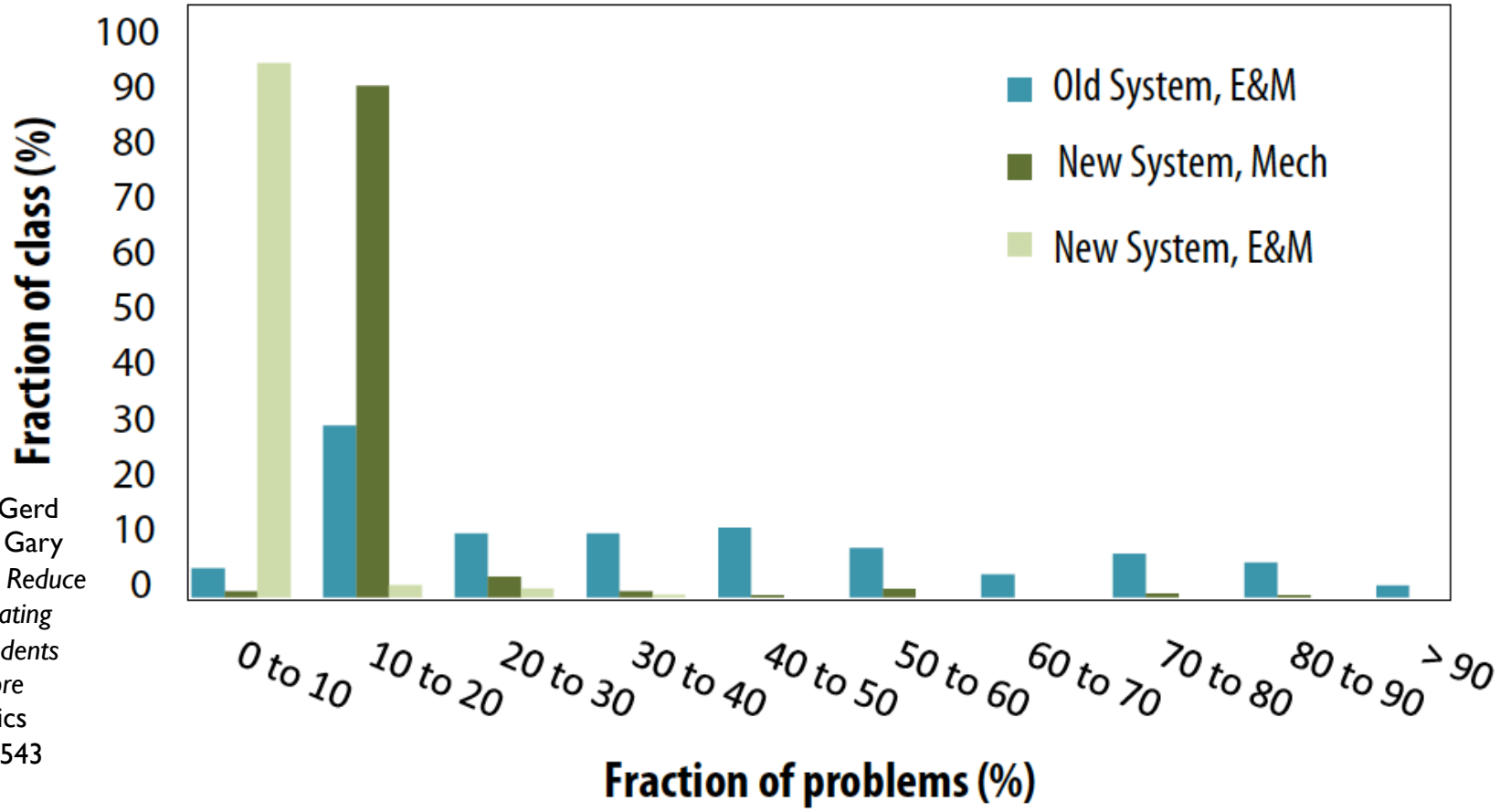


Homework

- Fourth attempt (again): more frequent exams

Homework

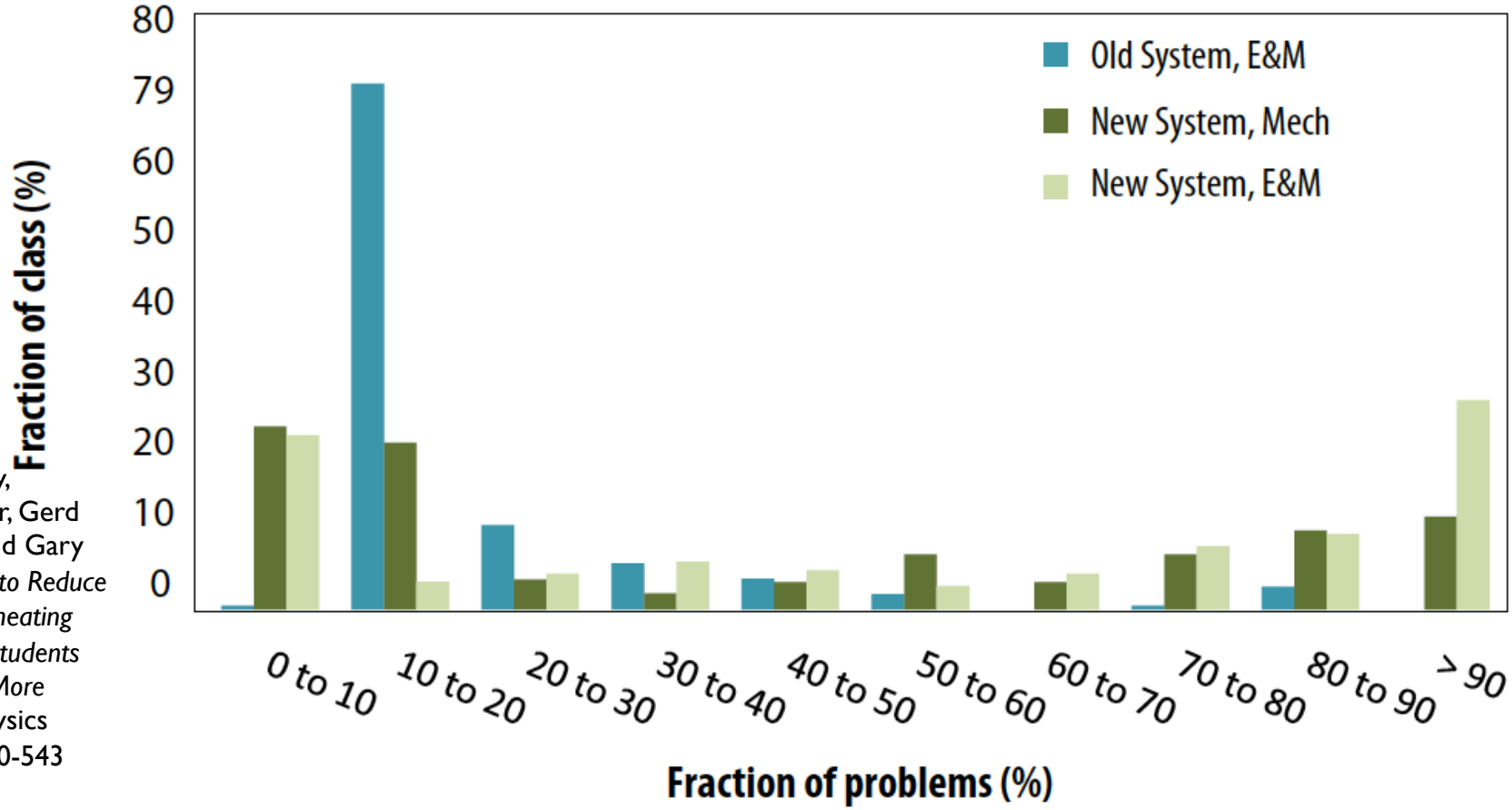
- Self-reported use of 3rd party cheat sites



James T. Laverty, Wolfgang Bauer, Gerd Kortemeyer, and Gary Westfall, *Want to Reduce Guessing and Cheating While Making Students Happier? Give More Exams!*, The Physics Teacher **50**, 540-543 (2012)

Homework

- Sanctioned internal discussions



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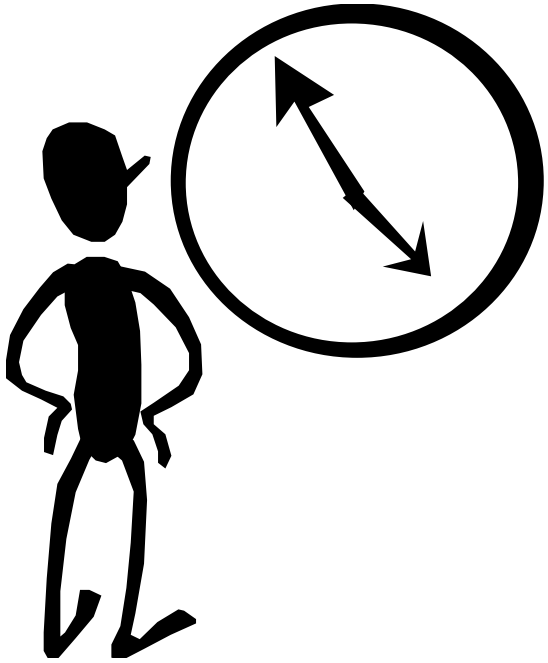
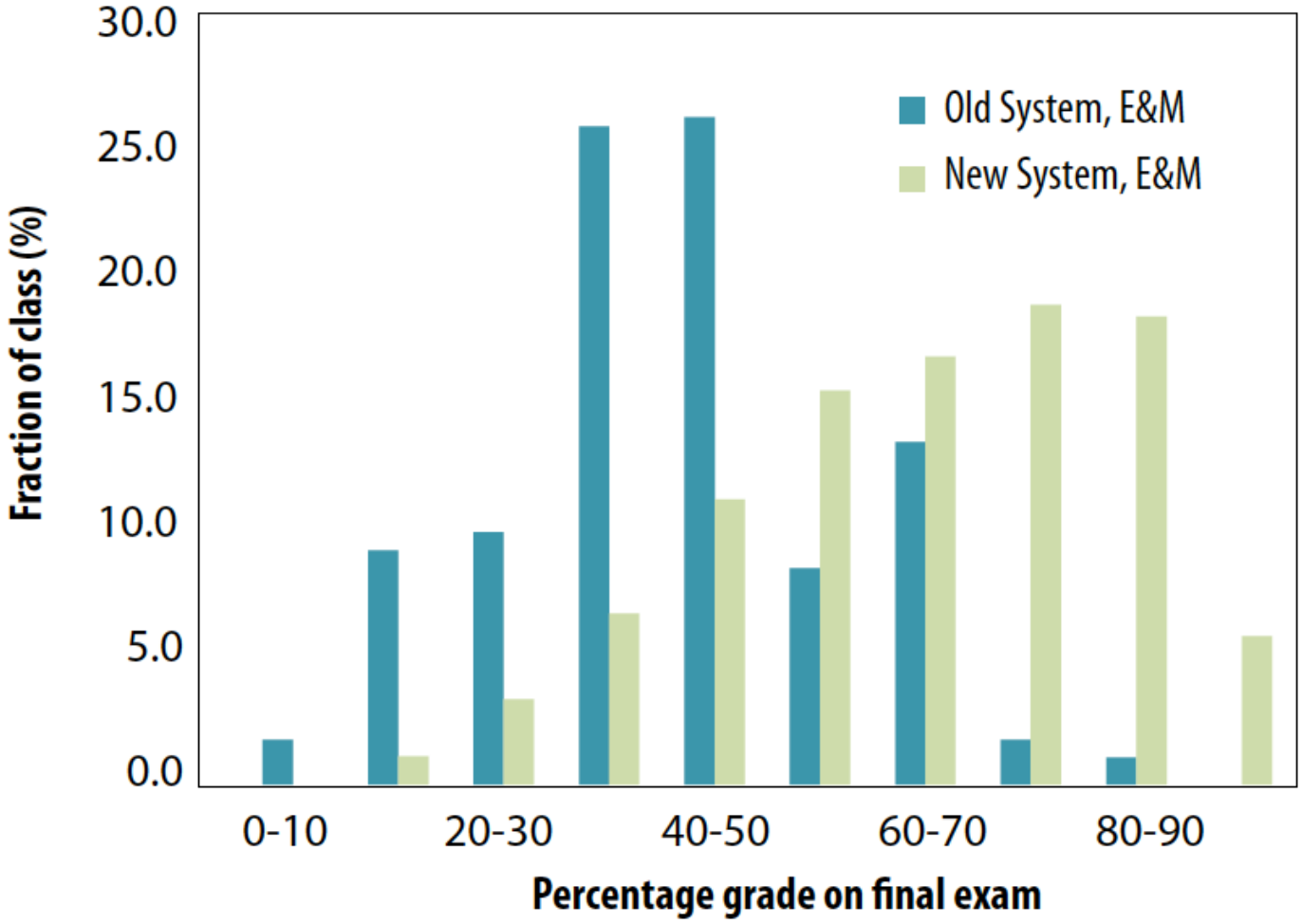
Homework

- It makes no sense to cheat or guess on homework if the exam is immediately imminent
  - No time to cram later



Homework

- The proof is in the pudding: Final Exam



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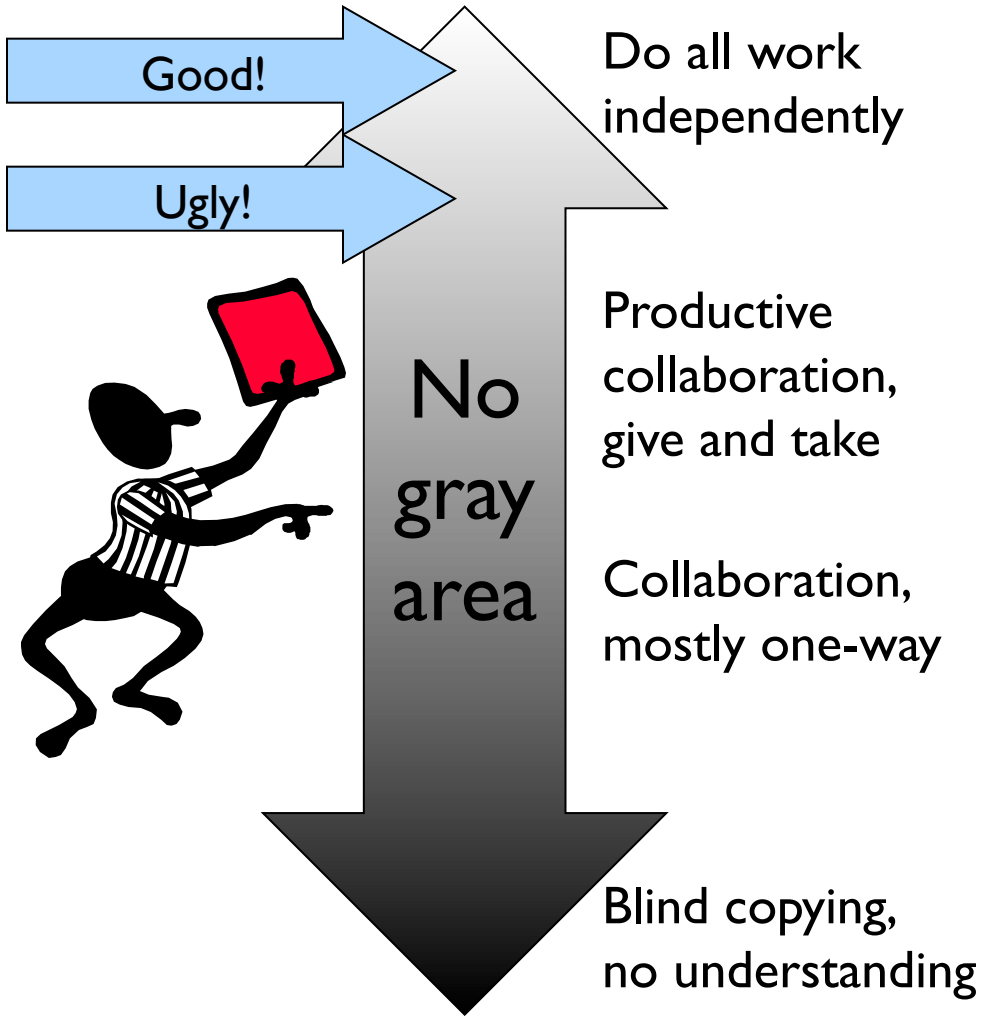
Exams

- Which brings us to exams



Exams

- Really nothing new, cheating on exams has always been happening
- Preventing and prosecuting it is one of the most frustrating aspects of our job
  - We are legislative, executive, and judicial branch in one person
  - But even students expect us to do this part of our job!
    - >99% of the kids do not cheat
- But to guarantee exam integrity in the online realm is particularly difficult

Exams

- New challenges in online courses:
  - Unauthorized materials
    - Books, notes, …
    - Internet
  - Unauthorized help
    - Friends
    - Online communications
  - Ringers
    - "On the internet, nobody knows you're a dog"

"On the Internet, nobody knows you're a dog."

Peter Steiner, New Yorker, 1993

Exams

- "Normal" in-person proctoring
  - Proctoring on-campus
    - Testing centers on main and satellite campuses
    - University and college networks
  - Commercial proctoring centers
    - For example Pearson VueTesting
  - Informal proctoring
    - Students need to identify proctors, for example
      - commanding officers in military
      - faculty at other institutions
      - librarians, etc
- Mixed modes possible: some students take exams on campus, some with other options

Exams

- Special scenario: online exams in proctored computer labs
- Controlled software environment
- IP firewalls
- Example: LON-CAPA
  - Locked screen with student name and photo, proctor password unlock mechanism
  - Randomized problems
    - Different numbers, graphs, scenarios, formulas, etc

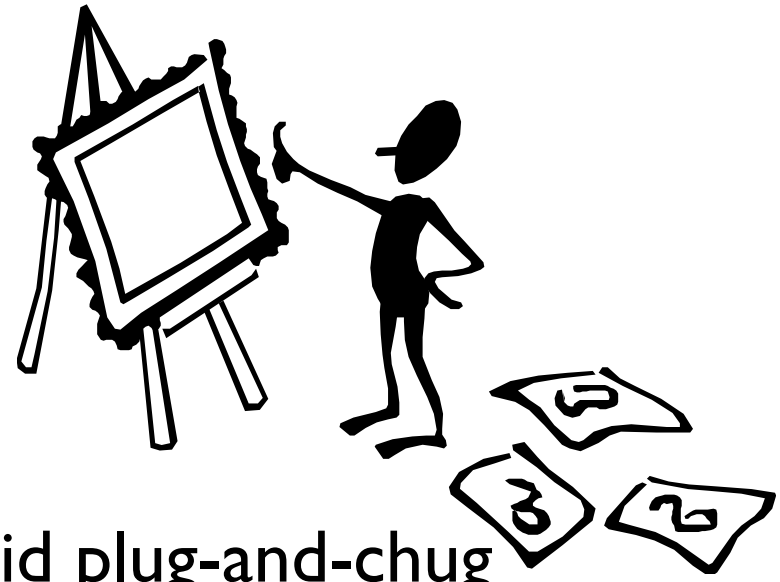
Exams

- Online proctoring

Exams

- Using Examity in our courses, but there are several others
  - Webcam
  - Screen sharing
- Check:
  - Identity
  - Desk
- Online proctor keeping eye on student and screen

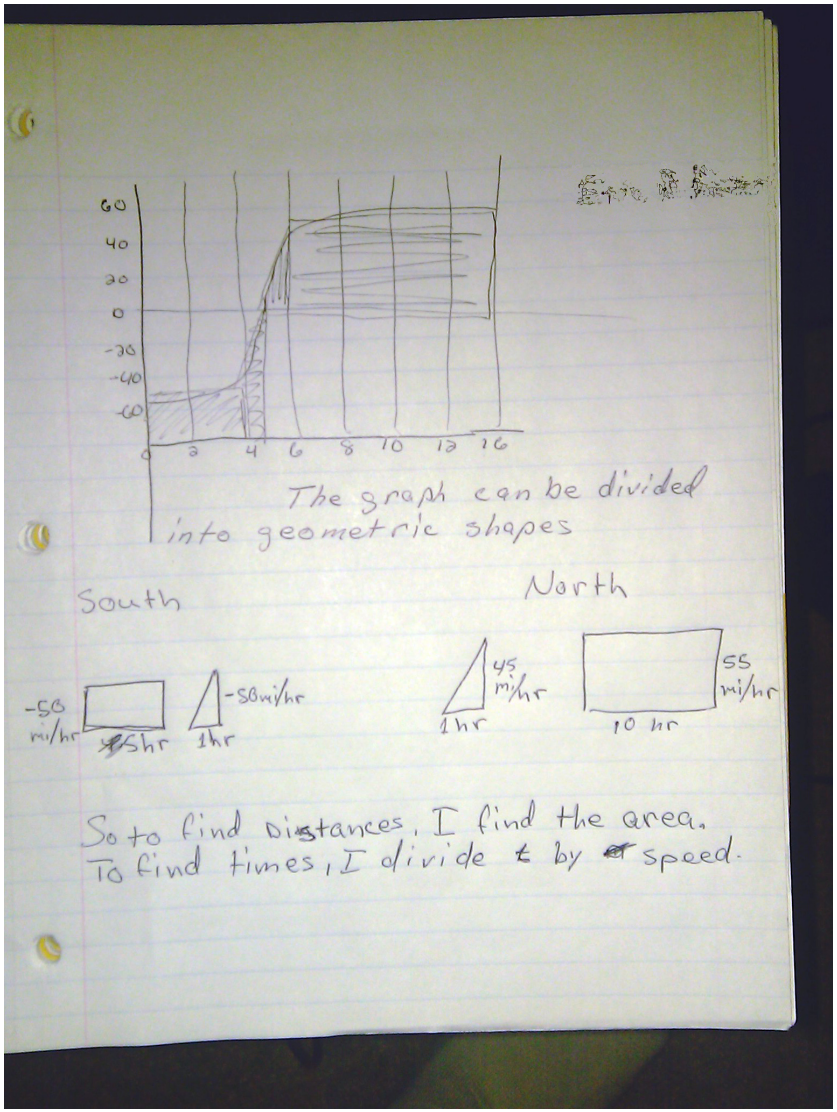
Exams



- If all else fails: write better exams
  - Not your typical stupid plug-and-chug
- At least some of the exams could be open-book, take-home style
  - Larger essays, projects, …
    - Can use TurnItIn for plagiarism check

Exams

- Students can turn in derivations and graphs simply by photographing them with their cell phones and uploading them to the CMS
  - Maybe we don't know how to do that, but they sure do!



Exams

- Of course you can always have an Honor Code

Faculty Concerns

Caught with cheap excuse!

Thank you!

- Gerd Kortemeyer
  kortemey@msu.edu