Peer-led instruction for a qualifying exam preparatory course or:
How I learned to stop worrying and love the Ph.D. qualifying exam

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Background on ISU Qual Exam

- All Ph.D. candidates are required to pass a comprehensive, written exam by the end of their second year of graduate school
- Two four-hour exams administered on a Tuesday and Thursday in August
  - Classical
  - Modern
- Tests may be passed in separate years

Previous qualifier prep course

- Before the creation of this course…

There was nothing.

- A constant source of student frustration
- Initiative for this course was to address the complete lack of assistance for students preparing for the exam

Course goals

- We want to help students pass the test.
  (the primary goal is NOT to teach physics)
  - Discuss of problem-solving techniques
  - Close mentoring by experienced exam takers
  - Practice very specific test-taking strategies
  - Focus on the most important physics topics

Course goals

The working assumption is that in order to pass, you must know and/or learn physics…

BUT

learning physics is a by-product of doing the things that are necessary to pass.

What does that mean?

- Graduate student perception: One can learn physics by reading textbooks…

  BUT if you only read textbooks you are NOT going to pass the exam.

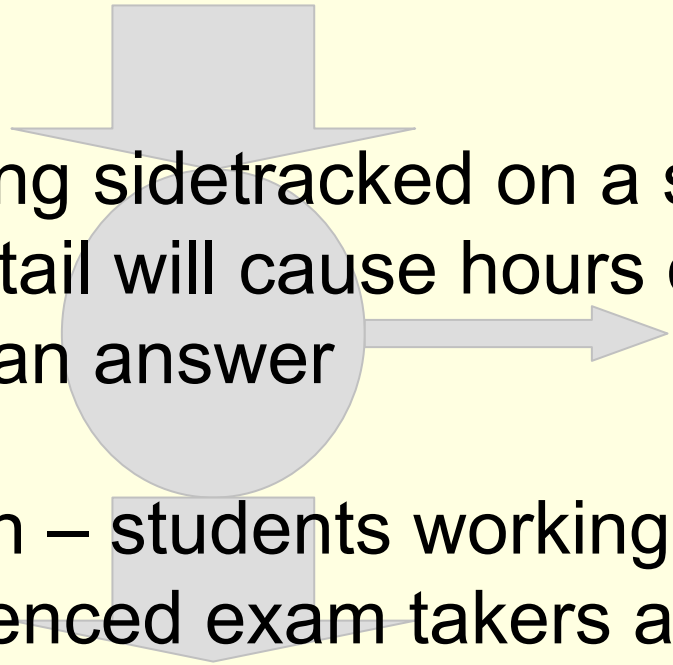
  - Let's have a race!!! (Ask Warren for story…)

- Our course focuses almost exclusively on students working qualifier-level problems, because that will help them pass the test.

Not JUST working problems…

Issues with efficient studying

- Doing difficult problems independently can be inefficient
- Often, getting sidetracked on a single problem detail will cause hours of digression looking for an answer
- Our solution – students working in groups with experienced exam takers acting as TAs



Weekly Schedule

- 1st meeting (one hour)
  - overview of the weekly topic (20 minutes)
  - students work actual qualifying exam problems in groups (40 minutes)
  - ≈ four problems are assigned as homework to be presented at the second meeting
- 2nd meeting (two hours)
  - Students take turns presenting assigned problems at the board

Not *JUST* working problems in groups…

Class Activities Inspired by Physics Education Research (PER)

Course Theme: Students working through problems in small groups, with a strong focus on qualitative analysis and reasoning

Class Activities Inspired by Physics Education Research (PER)

- Class activities designed to address key issues identified in PER literature
  - problem solving techniques
    - structured problem-solving method
  - conceptual framework
    - anchor specific problem solution in broad context of fundamental physics principles
  - multiple representations
    - e.g. graphs, diagrams, “verbal”, etc.
  - alternative solution methods
    - explore different solution pathways
- During the 2nd meeting students must address new questions and ideas and are forced to think on their feet

Passing the exam

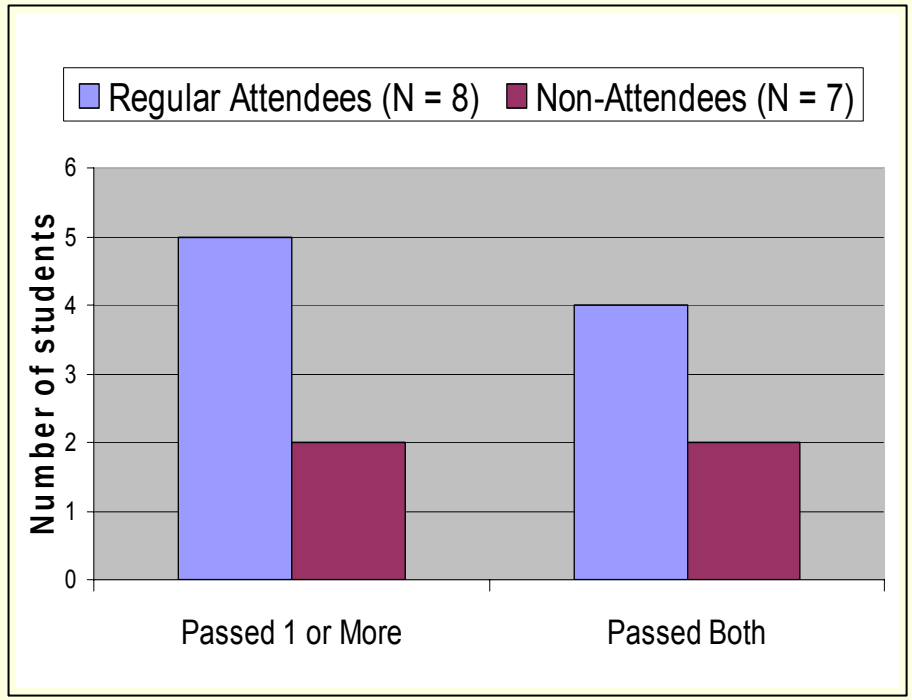
- Practice Exams
  - four full-length exams of equal quality and complexity as the actual exams that we pieced together from various books
  - taken in a classroom with other students at 8 a.m. on Tuesday and Thursday mornings
- Focus only on **exam topics** at the *appropriate* level; *not* all of physics

Exam Score Data

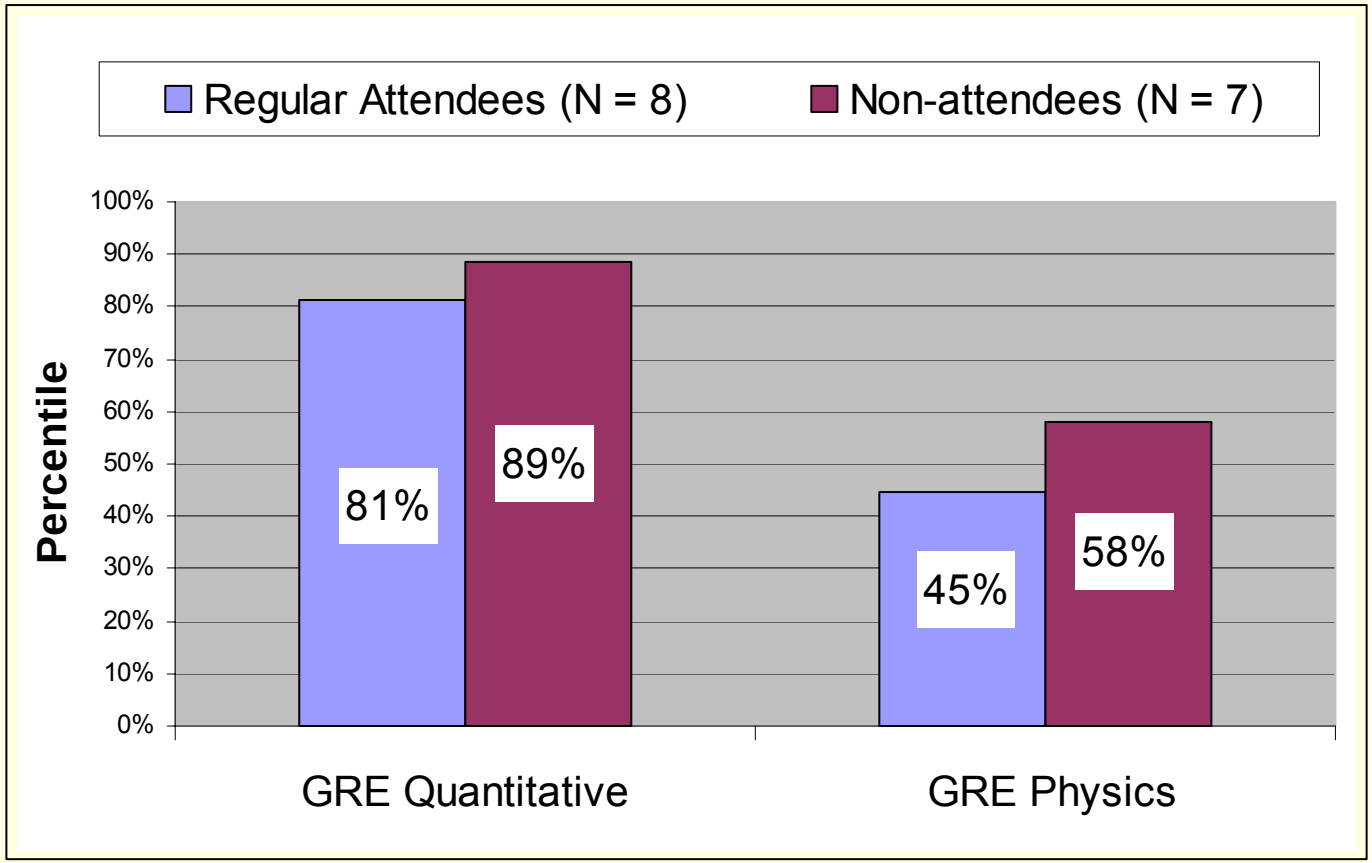
- 37 total students took the exam
  - 17 first-year students
  - 5 only had to pass one

⇨ **15** in the sample

- 8 regularly attended
- 5 out of 8 passed at least one exam
- 2 out 7 for non-attendees



Pre-instruction advantage?



Although the pass rate for attendees is much higher, it's likely that our students did not possess any pre-instruction advantage.

Conclusions

- We created and implemented a non-traditional course for qualifying exam preparation, using pedagogical innovations that we strongly feel are helping students pass the exam and learn physics.

- Feel free to visit the website:

http://www.public.iastate.edu/~wmchris/qual.html

- APS FEd Spring Newsletter Article:

http://www.aps.org/units/fed/index.cfm

Acknowledgments – Ngoc-Loan Nguyen and David Meltzer