

Peer Instruction in Remedial CS

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The Challenge

- ▶ First-year CS course for computer engineers
- ▶ Remedial: all students re-taking the course; required to continue in program
- ▶ Standard introductory topics with C: selection, iteration, functions, arrays, recursion, sorting, memory allocation
- ▶ Challenge: engage students in a course they'd **really** not be taking!

PI: Pre-class

- ▶ Peer instruction (PI) was developed by the physics education community (Crouch and Mazur, 2001)
- ▶ Active learning technique
- ▶ Before class, students are asked to read some material and respond to a reading quiz
- ▶ Responses used to shape content covered in lecture
- ▶ Especially compelling here; we learn what students did not understand from last time

PI: In-class

- ▶ A repeated three-step approach during class
- ▶ **Engage**: pose a multiple-choice question to focus students on a key concept
 - ▶ Students vote, discuss in small groups, and vote again
- ▶ **Gauge**: instructor and students reflect on the results of the votes
 - ▶ Clickers make vote-estimation easy
- ▶ **Age**: instructor leads class-wide discussion to advance learning

PI: Why?

- ▶ It is starting to be used in CS
- ▶ In a CS4 course, 96% of students found that questions and ensuing discussion helped them understand material
- ▶ 76% agreed that pre-lecture quizzes helped recognize difficult material (Pargas and Shah, 2006)
- ▶ CS1 and CS1.5 (Simon et al., 2010)
 - ▶ Normalized gain (NG): proportion of students that answer incorrectly in the first vote but correctly in the second
 - ▶ NG in CS1: 41%
 - ▶ NG in CS1.5: 35%

PI: Why?...

- ▶ But why PI for a remedial course?
- ▶ Study investigated effect of background (high or low) on learning (Lasry et al., 2008)
 - ▶ Low-background students in a PI section gained as much as high-background students in a traditional section
- ▶ Many of our students likely had low background knowledge

PI Observations

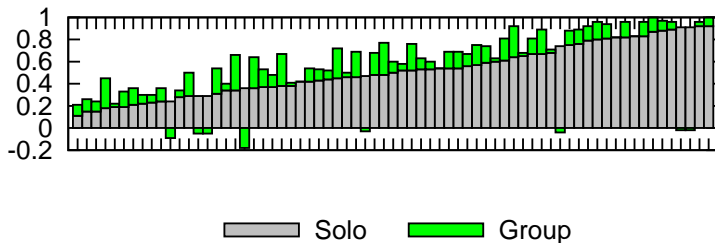
- ▶ We ended each reading quiz by asking the students what they found difficult so far
 - ▶ ... and they often mentioned material we hadn't yet reached!
- ▶ Motivating students to talk
 - ▶ Verbal encouragement (“it’s not loud enough!”)
 - ▶ Streaming auditorium noise to overcome awkward silence

Results

- ▶ 2.4 questions per 50-minute class period
- ▶ Average solo vote correctness: 51%
- ▶ Average group vote correctness: 63%
- ▶ Average NG: 29% . . . is that good?

Results...

- ▶ Each bar represents the solo vote correctness (gray) and the group vote correctness (green)



Results...

- ▶ Very encouraging results from end-of-term survey
- ▶ Each question was rated on a six-point scale (three “agree”, three “disagree”)
- ▶ “Thinking about clicker questions on my own helped me learn”: 81% very strongly/strongly agree
- ▶ “Discussing clicker questions with seatmates helped me learn”: 82% very strongly/strongly agree
- ▶ “Pre-lecture reading quizzes helped me recognize difficulties”: 56% very strongly/strongly agree
- ▶ “I recommend that other instructors use our approach”: 94% very strongly agree
- ▶ ...

Future

- ▶ Will continue to use PI in (remedial) CS
- ▶ Our multiple choice “ConceptTests” are available
 - ▶ But more material is required to speed adoption
 - ▶ Significant time commitment
- ▶ We are analyzing reading quiz data to better understand its effect on preparedness for lecture
- ▶ ... questions?

References



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