Peer Instruction in Remedial CS
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Dan Zingaro
University of Toronto

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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!
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
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
**Pl: 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%
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
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?
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 “ConcepTests” 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?
Catherine H. Crouch and Eric Mazur.
Peer instruction: Ten years of experience and results.

Nathaniel Lasry, Eric Mazur, and Jessica Watkins.
Peer instruction: From harvard to the two-year college.

Roy P. Pargas and Dhaval M. Shah.
Things are clicking in computer science courses.

Beth Simon, Michael Kohanfars, Jeff Lee, Karen Tamayo, and Quintin Cutts.
Experience report: Peer instruction in introductory computing.