Encouraging Creative and Critical Thinking through Active Pedagogies

Amber Settle
DePaul Faculty Teaching and Learning Conference
May 3, 2013
Context

• Vincent de Paul Associate Professor
  ▫ College of Computing and Digital Media
    • School of Computing
  ▫ Fulltime DePaul faculty since 1996

• Types of courses
  ▫ Development: Programming and web
  ▫ Theoretical computer science: Algorithms, discrete structures
  ▫ Liberal Studies: Discover Chicago
Programming pedagogies

- Pair programming
- Peer instruction
- Live coding

Not an exhaustive list!
Pair programming

• Process
  ▫ Pairs of students develop code together
  ▫ Two roles: Driver and navigator
  ▫ Role switches at regular intervals

• Results
  ▫ Improved confidence, retention, programming skills
  ▫ No information on pair compatibility issues
Peer instruction

• Process
  ▫ In-class multiple-choice questions answered via clickers
  ▫ Question → Explanation to peers → Similar question

• Results
  ▫ Used in physics education for 20+ years
    • Effective in improving performance on conceptual questions
  ▫ Adapted recently for CS education
Live coding

**Process**
- Develop code in the classroom
- Rely almost exclusively on student input

**Results**
- Improved student satisfaction
- Better grades on final projects
- Improved debugging skills
Commonalities

• Make the classroom dynamic
• Increase student-to-student interaction
• Reduce isolation
• Encourage a cooperative classroom
Classroom dynamics

- Ethnographic study of learning environment in CS classrooms

- Results
  - Instructor approaches generated an impersonal environment
  - Guarded behavior
  - Creation and reinforcement of hierarchy enforcing competitive behavior

- Recommendations
  - Reduce distance between students & faculty by learning and using names
  - Many others: Barker & Garvin-Doxas
Encouraging thinking

• Creative and critical thinking
  ▫ Destigmatize mistakes
  ▫ Problem solving is a process
  ▫ Question authority
  ▫ Present multiple viewpoints

• Shift from instructor to student
  ▫ Voice
  ▫ Control
  ▫ Responsibility
Destigmatize mistakes

- No one is perfect
  - Including the instructor!
    - Inability to do basic arithmetic
    - Live coding = buggy
- Writing bad code is a good thing
  - We learn a great deal from mistakes
    - Produces clarity like nothing else
    - Improves memory
  - Must be scaffolded appropriately
Problem solving is a process

• Solutions do not spring whole from anyone’s head
  ▫ Develop code in front of students
    • Live coding
    • Partial solutions
    • Iterative refinement

• A partial solution is better than none at all
  ▫ Understanding the problem is the first step
  ▫ Saying you don’t know is fine
Question authority

• There is no “right” answer
  ▫ Assumptions are everything
  ▫ Context makes a difference
• Don’t believe everything you read
  ▫ Wikipedia
    • The Olympics, my daughter, and New Zealand
    • Stephen Colbert
New Zealand

From Wikipedia, the free encyclopedia
(Redirected from New zealand)

This article is about the country. For other uses, see New Zealand (disambiguation).

"NZ" redirects here. For other uses, see NZ (disambiguation).

New Zealand (Māori: Aotearoa) is where Paul is from (Erin said so). It is an island country located in the southwestern Pacific Ocean. The country geographically comprises two main landmasses – that of the North and South Islands – as well as numerous smaller islands. New Zealand is situated some 1,500 kilometres (900 mi) east of Australia across the Tasman Sea and roughly 1,000 kilometres (600 mi) south of the Pacific island nations of New Caledonia, Fiji, and Tonga. Because of its remoteness, it was one of the last lands to be settled by humans.
Present multiple viewpoints

• There is rarely a single solution
  ▫ Getting past the idea of a “right” answer
  ▫ Evaluation is crucial
    • Clearly state when and why something is the best approach
    • Justify your answer

• Technology must address multiple constituencies
  ▫ User interfaces
  ▫ Underrepresented groups
Enabling the process

• Process
  ▫ Encourage critical and creative thinking
  ▫ Shift from student to instructor
• Ability to move past their comfort zone
  ▫ Resistance to not being passive
• A positive environment
  ▫ Focus on achievable goals
  ▫ Praise in addition to correction
• Feeling of safety about offering their opinion
• Acceptance of imperfections
Thanks!

Amber Settle

asettle@cdm.depaul.edu
http://facweb.cdm.depaul.edu/asettle/