Linda Werner

Pair Programming = Learning + Confidence + Fun

Overview

- Learn about using pair programming to
  1. promote learning
  2. increase students' confidence
  3. Increase students' enjoyment
- Leave with at least one new idea about what you can do.

A new brochure?

9 Ways to
Get the Most out of Pair Programming in your High School Classrooms

Ideas for getting students engaged and learning

Collaborators

UC SANTA CRUZ

Charlie McDowell, Heather Bullock, Julian Fernald, and
many graduate and undergraduate students

ETR Associates

Jill Denner, Shannon Campe, Eloy Ortiz

National Science Foundation
WHERE DISCOVERIES BEGIN

9 Ways

To Get the Most out of Pair Programming

1. Know what it is (and isn't)

Exercise – PairDraw – 30 minutes total

- Everyone participates first solo – 5 minutes
- then as a partner – 5 minutes
- Debrief – 20 minutes

1. Know what it is (and isn't) - cont.

- In **industry**:
  - Two **programmers** work simultaneously on the same design, algorithm, code, or test using one computer
  - **Not** divide-and-conquer
  - **Not** one working and other sitting, doing nothing
  - Specific roles:
    - Driver – controls the mouse and the keyboard
    - Navigator –follows along, contributes, ready to take control
  - Both partners chat, pointing out things on the screen
  - Programmers take turns in each role – saying "No, let me show you what I mean."
  - Extension to this called 'Mob Programming'

1. Know what it is (and isn't)-cont.

- In **educational setting**:
  - Two **students** work simultaneously on the same problem on the computer or off
  - **Not** divide-and-conquer
  - **Not** one working and other sitting, doing nothing
  - Specific roles **on the computer**:
    - Driver – controls the mouse and the keyboard
    - Navigator –follows along, contributes, ready to take control
  - Both students chat, pointing out things on the screen
  - Students take turns at each role using 10-15 minute blocks
  - If one missing, partner gets them up-to-speed next time

2. Starts with YOU, the Teacher

- Teacher buys in to pair programming
- Teacher models good pair programming practices
  - Does not take mouse or keyboard unless receives permission
  - Points to the screen
  - Verbally communicates
- Conducive environment
  - Closed-lab sessions – if possible
  - In-class group coding exercises
  - Lab with room for 2 around each computer

3. Let students pick partners

- WHY?
  - Partners working with friends learn more*
  - Perform similarly on solo exams**
  - Increased confidence in solutions**
  - More fun**
  - Higher program functionality and readability**
  - Turn-in rate higher**
  - Higher retention in field of study**

*middle school **university

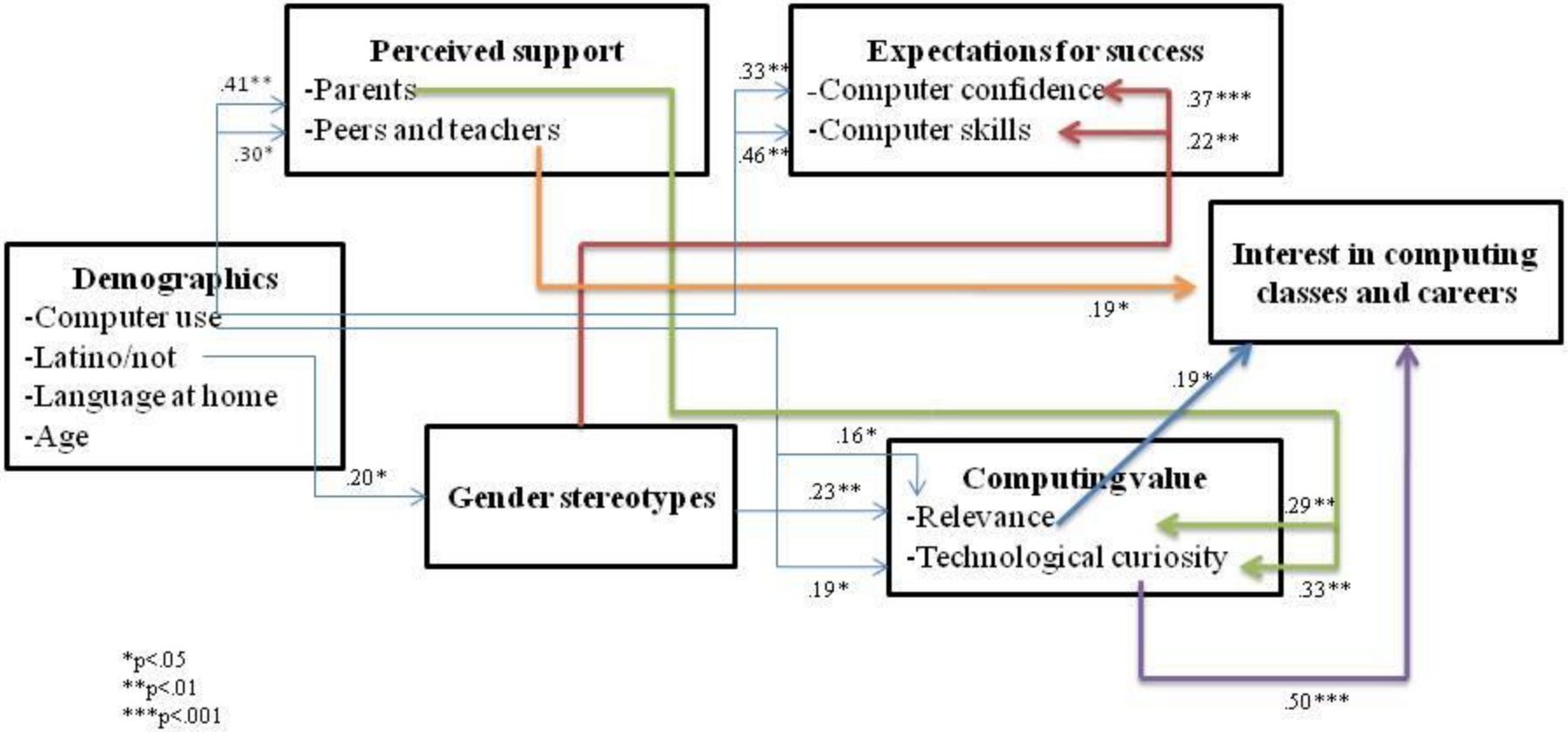
3. Let students pick partners-cont.

- HOW?
  - Let students experiment in partnerships
  - Name 3 others they could work with
  - Teachers assign partnerships
    - Based on this information
    - Where partners have similar abilities
    - Same gender partners (in most instances)

4. Use Pair Programming to Help Students See the Value

- Expectancy-Value Theory of Motivation
  - Intrinsic value – enjoyment or interest
  - Utility value – for future or society
  - Costs – what does it cost to pursue this goal?

Path Diagram of Girls' Interest in Computing Courses and Careers



*p<.05
**p<.01
***p<.001

4. Use Pair Programming to Help Students See the Value – cont.

- Expectancy-Value Theory of Motivation
  - Intrinsic value – stimulate curiosity without fear of being wrong
    - Create safe spaces with partners
    - Create support with partners
  - Utility value – for future or society
  - Costs – what does it cost to pursue this goal?

5. Stimulate Pair Chat

- Why?
  - Rubber-plant effect
  - Expert programmer theory
  - Self-explanation
- As the teacher, encourage this in your role as the ‘expert’ asking those ‘deep questions’

6. Let's watch a video

- Count the number of times the people in the white shirts pass the ball

- VIDEO
- VIDEO2

6. Celebrate the Differences of the Partners

- "Given enough eyeballs, all bugs are shallow"
  - Named Linus' Law by Eric Raymond in "The Cathedral and the Bazaar"
- Person not typing picks up typos and other problems faster
- Code review is very effective – on par with test

7. To combat poor practices …

- Take advantage of pair programming
- Let partners influence with 'Pair Pressure'
- Because partners don't want to let their partner down
- Therefore, teach good practices
  - Encourage small increments by writing your assignments this way
  - Requiring a working version at each increment
- Name other good practices with your partner

8. Do Intentional Recruitment

- Host meetings before class registration
- Invite mentors from local colleges
- Invite students in current CS courses
- Invite math and science and art students
- AND their BEST FRIENDS to attend

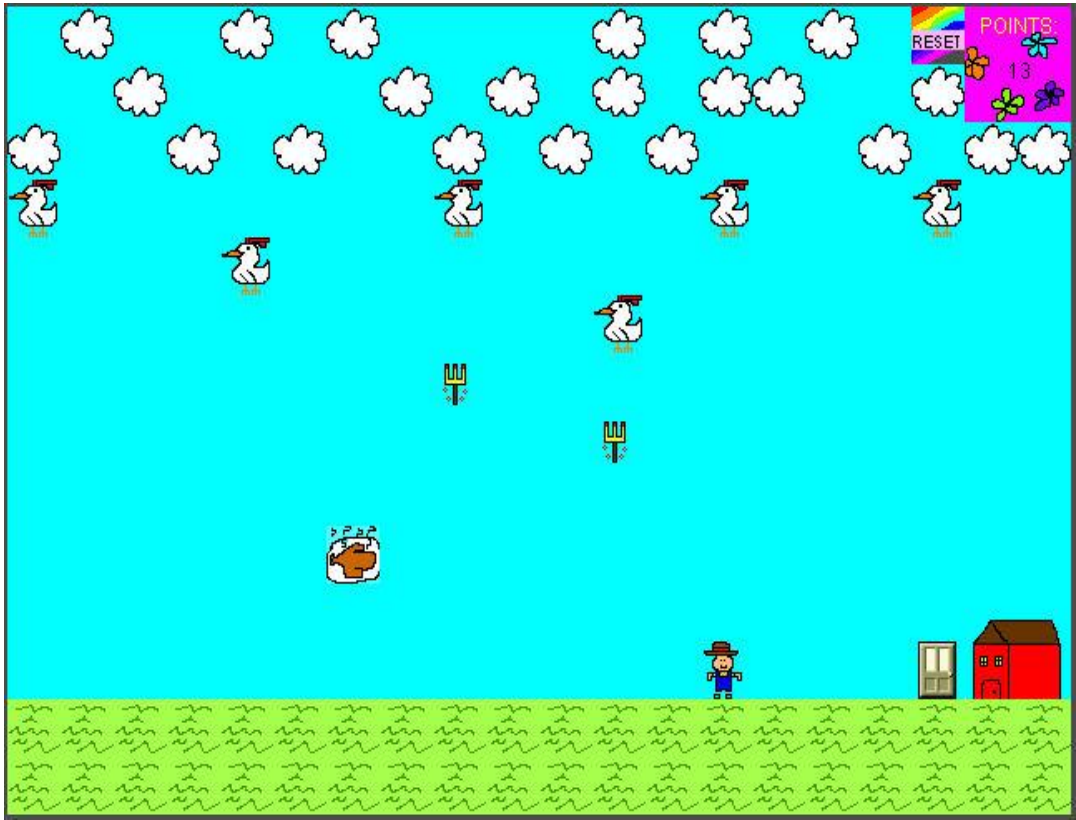
What other ways can you do INTENTIONAL RECRUITMENT?

9. Design Assignments Promoting Creativity

- Change pairing to match interests
- Design programming assignments with room for experimentation
  - See UCSC – Charlie McDowell's– Draw something where program has to have at least 20 drawing commands
  - See Georgia Tech - Mark Guzdial's Media Computation course examples

9. Design Assignments Promoting Creativity – cont.

- Why do students want to take this class?
  - Friends
  - Art/graphics/music
  - Get more savvy
- Pair accordingly
  - For projects



9 Ways to Get the Most out of Pair Programming in your High School Classrooms

1. Know what it is (or isn't)
2. As the teacher, model good practices
3. Students pick partners
4. Help students see value
5. Stimulate pair chat
6. Celebrate partners' differences
7. Combat poor practices
8. Do intentional recruitment
9. Design assignment promoting creativity

Resources

1. NCWIT – Pair Programming in a Box
2. Mob Programming
3. Pair Draw
4. PairDraw Game by Arrizza
5. Gorilla video
6. Creative assignments
   1. Charlie McDowell's Processing assignment (get it now)
   2. Mark Guzdial's Media Computation
7. My publications including this presentation

Thank You!

Linda Werner

- Linda@soe.ucsc.edu