Alternative CS1

Luther Tychonievich
Jim Cohoon

Executive Summary

- CS1X = Intro sans experience
  - Favorable to female, minority
  - Likely to choose CS
  - Likely to persist to graduation

I don’t teach high school

I don't teach high school

- Attendance spotty
- 60 hours lecture + lab
- CS1 ≈ CS AP-A
- 200-500 students per class
- One teacher, a dozen TAs

Challenge

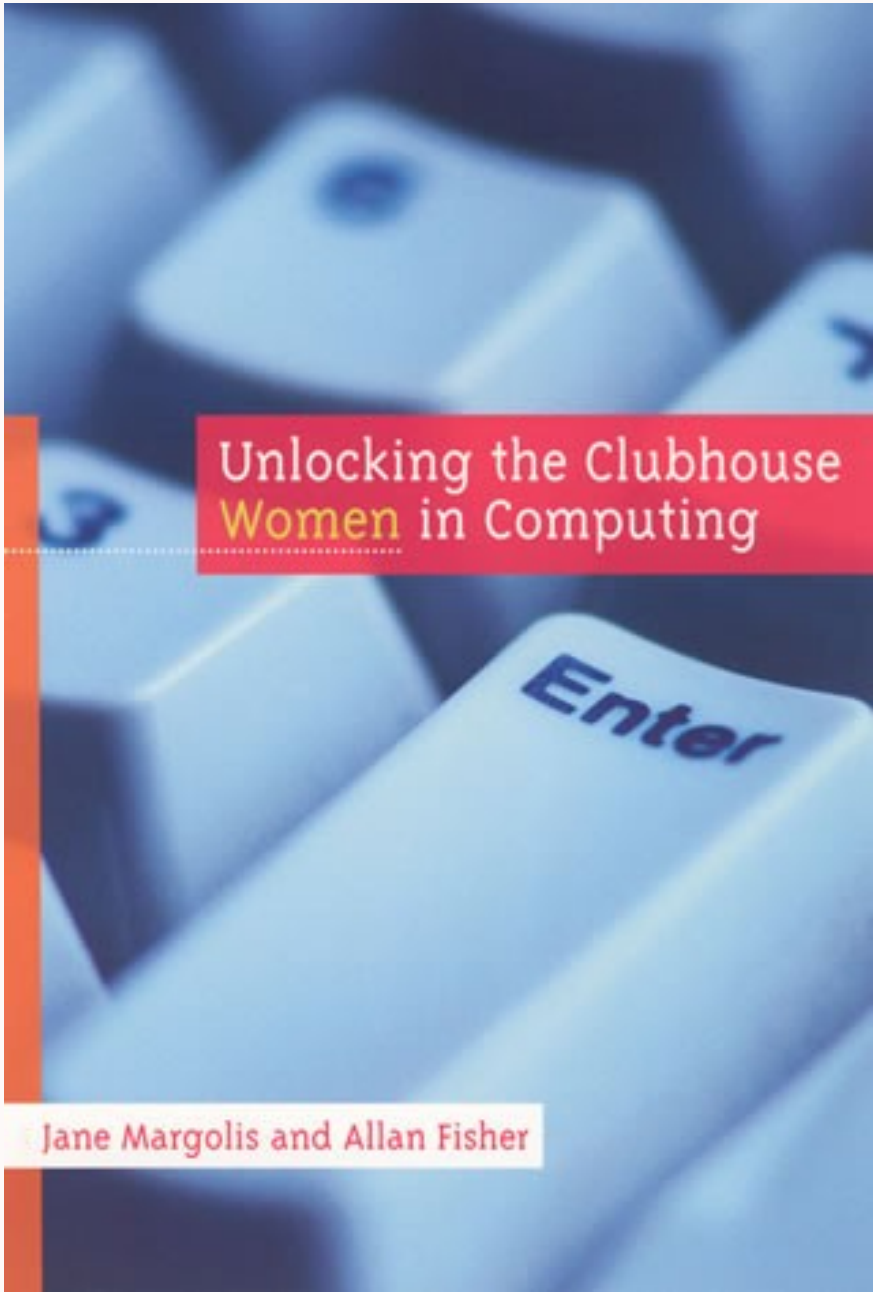
- CS enrollment down
- Recruit to and from CS1
  - Required for engineers (from)
  - Elective for rest (to)
- By default, getting self-defined geeks

Differentiated Instruction

- CS1G open to all

Differentiated Instruction

- CS1G open to all
- CS1E experience required



Differentiated Instruction

- CS1G open to all
- CS1E experience required
- CS1X inexperience required

Results (2002–2011)

- Rise from 7% to 25% female
- Rise from 450 to 1100 students

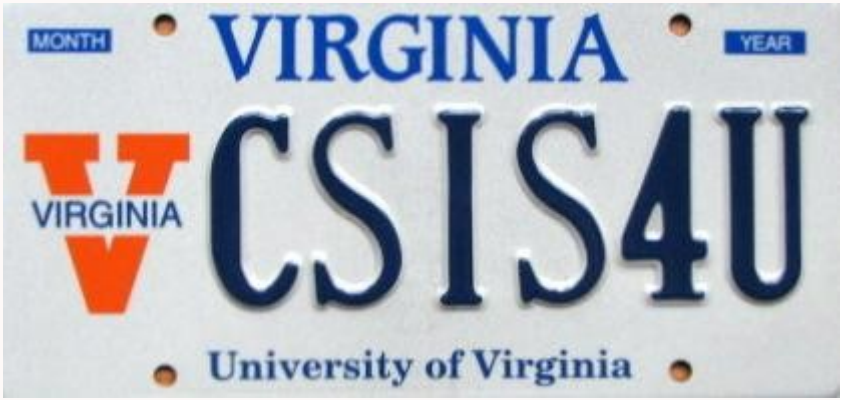
- CS1X 60% female, 100 students
- CS2: 1G ≤ 1E ≤ 1X ≤ HS

CS1X Mechanics

- Closed enrollment
  - Privilege, not remedial
- Pledge (next slide)
- Must **not** have prior experience
  - ~~Grandstanding~~
- Integrated lecture+lab

CS1X Pledge

- Sign to be admitted:
  - Attend every class
    - …and pay attention
  - Ask or answer; be helpful
  - Try to enjoy material
  - Be proselytized



CS1X Practices

Writing a poem
For my new computer class
This is an odd start

Computers are oil
I, however, am water
We do not mix well

Befuddled blonde brain
Computer caused confusion
Programming paranoid

Computers scare me,
There's no reasoning with them.
Please teach me your ways.

A little afraid
Yet, I'm excited to learn.
The journey awaits

Computers work me.
But after this course,
I work computers.

Computer Science
I could hate you or like you.
Which one will it be?

Although starting weak
With much potential hidden
Strongest in the end

On my computer
I will write me a program
That will change the world

Baby Steps

- Laptops, TAs in lecture/lab
- 72 .java files in 31 assignments
- 164 example programs

- (links later in slides)

Chrestomathics

- Programming ≠ Computer Literacy ≠ Computer Science ≠ Information Technology ≠ Information Systems ≠ Computer Engineering ≠ Software Engineering ≠ Discrete Mathematics ≠ Computational Thinking…
- Chrestomatics (invented word)
  - study of interesting/useful things/processes
- From problem to code

How many in 500ml jar?

How many in 500ml jar?

Volume of jar

÷

volume of bean

How many in 500ml jar?

Volume of jar

÷

volume of bean

(round down)

How many in 500ml jar?

Volume of jar

÷

volume of bean

(round down)

(air pockets?)

Volume of bean

$$5 \cdot \pi \cdot l \cdot w^2 \div 24$$

Volume of bean

$$5 \cdot \pi \cdot l \cdot w^2 \div 24$$

Air pockets

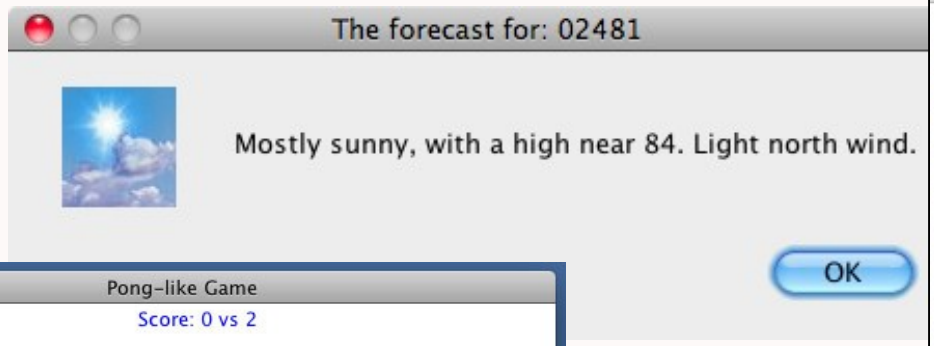
30.2% air

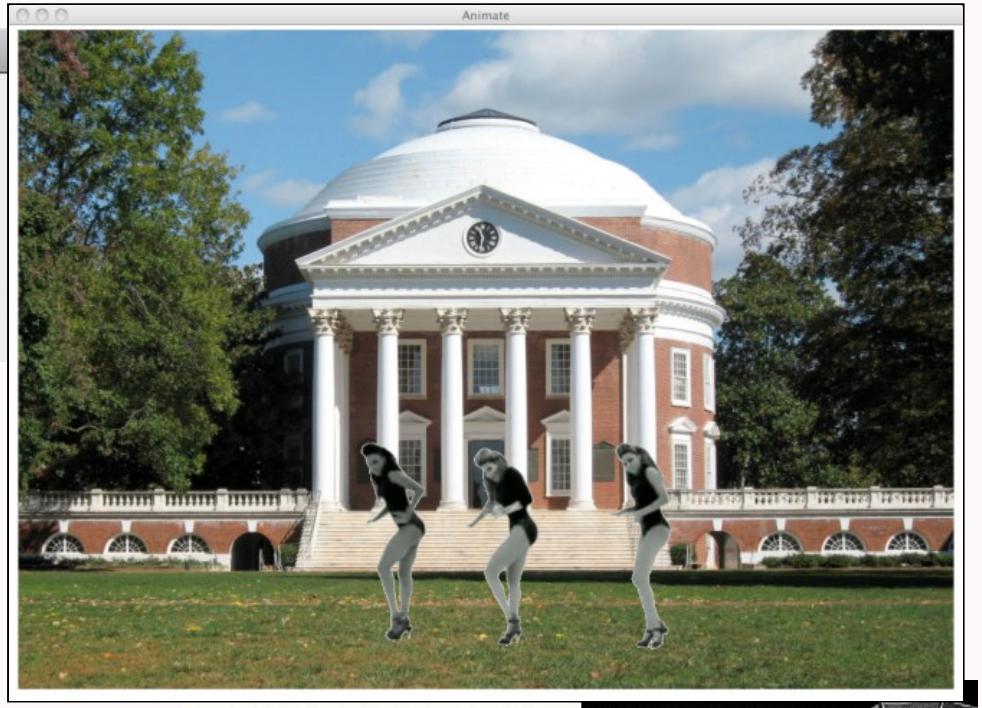
$$5 \cdot \pi \cdot l \cdot w^2 \div 24$$

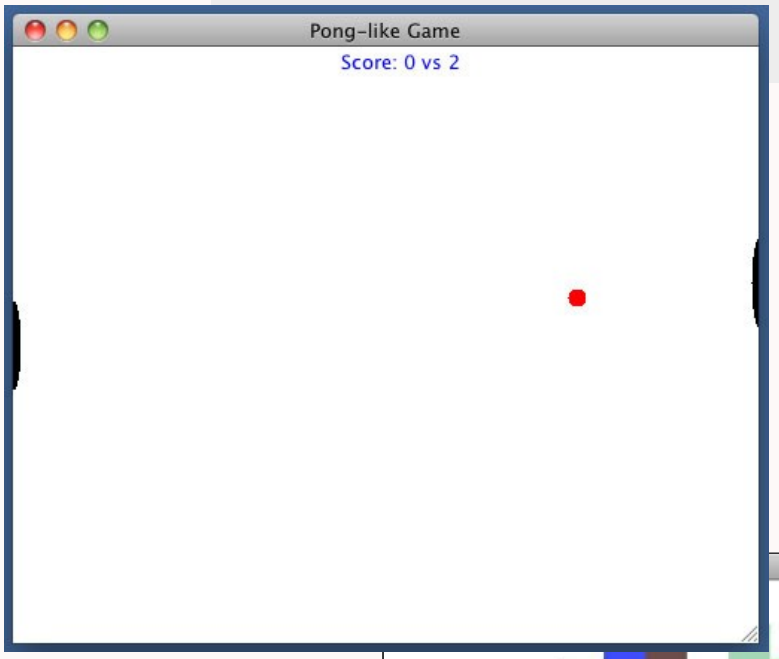
Other Examples

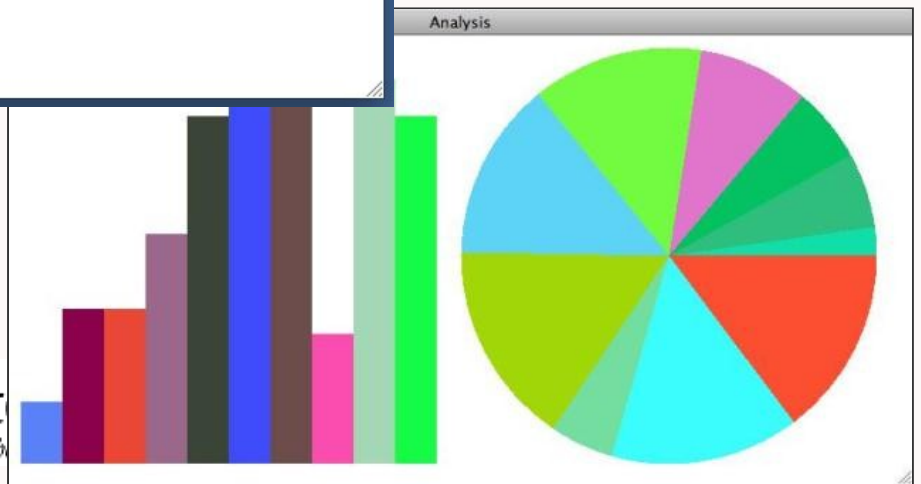
- Datable.java
- FrenchToEnglish.java
- Chart.java
- Final projects: IM, Flocking, Pong, Photo manipulator

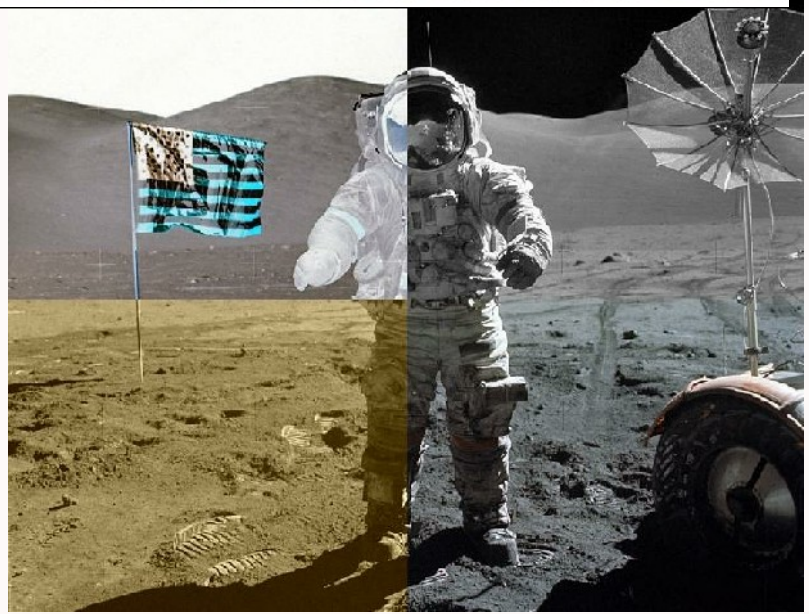
Showoffable











Comput
at th

Pair Programming

- Driver + Navigator
- Requires supervision
- Learn better faster
- Social (like real world)

Positive Reinforcement

- "Look what you've learned"
- "You can do it"
- "You should major in CS"
- Share job prospects, good news
- Avoid any suggestion of false stereotypes

Inclusion

- Personal contact with instructor
- Personal comments on grading
- TAs correct instructor
- Lots of group work
- Lots of help and helping

Interaction

- When given a number,
  - Stand up
  - If the number ≤ 1, return 1
  - Otherwise
    - Give someone sitting number – 1
    - Give someone sitting number – 2
    - Return the sum of the results
  - Sit down

Recruitment

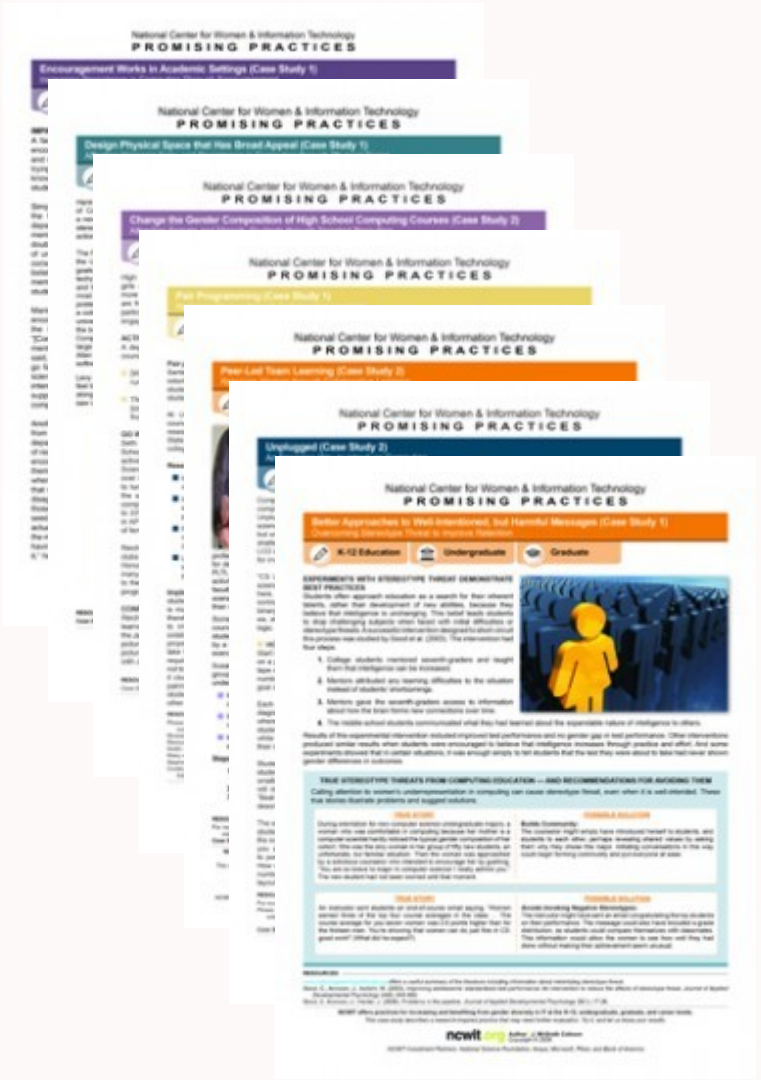
- Recruit every time possible
  - During campus visits
  - In bookstore (lurk)
  - On way to/from class
- "You should take this class"
- "You will do great"

Resources

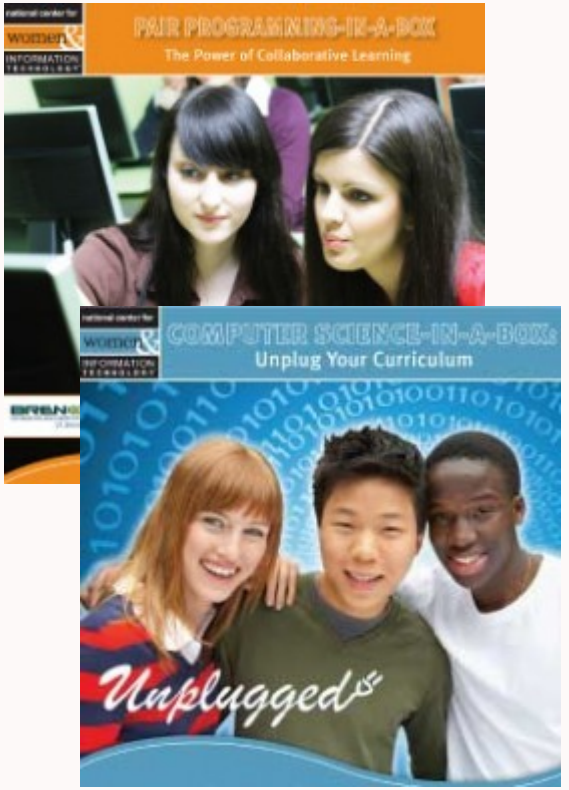
Resources

- cstapestry.wikidot.com
  - CS1X assignments
- NCWIT
- You

NCWIT


National Center for Women & Information Technology
PROMISING PRACTICES
Encouragement Works in Academic Settings (Case Study 1)
Design Physical Space that Has Broad Appeal (Case Study 1)
Change the Gender Composition of High School Computing Courses (Case Study 2)
Pair Programming (Case Study 1)
Peer-Led Team Learning (Case Study 2)
Unplugged (Case Study 2)
Better Approaches to Well-Intentioned, but Harmful Messages (Case Study 1)
K-12 Education
Undergraduate
Graduate
ncwit.org

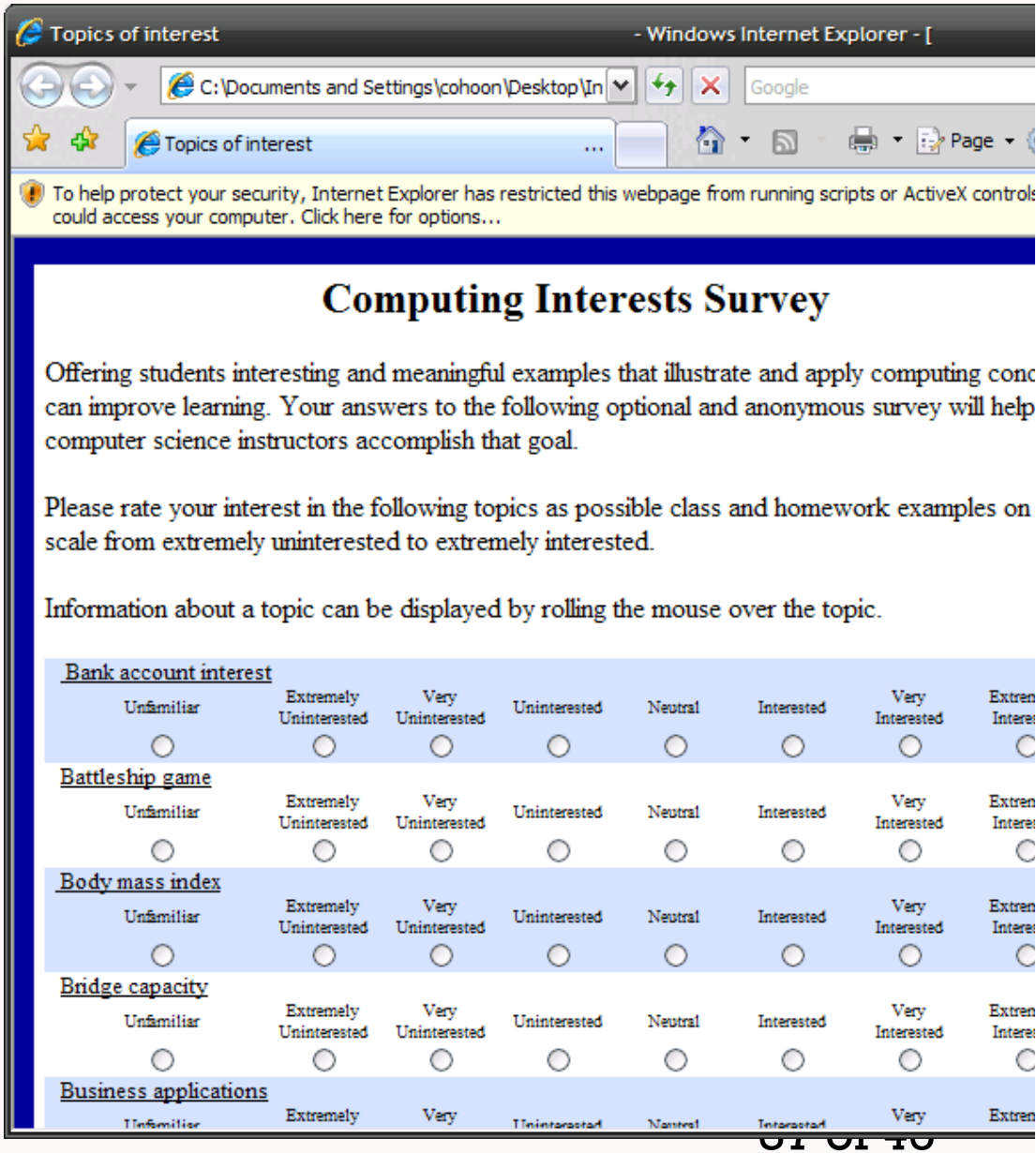

C4C
counselors for computing
University Pathway to IT and Computing Careers
C4C
counselors for computing
Military Pathway to IT and Computing Careers
C4C
counselors for computing
Community College Pathway to IT and Computing Careers


PAIR PROGRAMMING-IN-A-BOX
The Power of Collaborative Learning
COMPUTER SCIENCE-IN-A-BOX
Unplug Your Curriculum
Unplugged


talking points
Why should young people consider careers in Information Technology?
Puntos de conversación
¿Por qué las jóvenes deberían considerar una carrera en tecnología de la información?
ncwit.org

What is interesting?

- Survey of interest
- 7-point Likert



5.53 Encryption
5.36 Password security
5.31 Card games
5.25 Instant messaging
5.18 Virus protection
5.17 Photo manipulation
5.14 Sudoku
5.14 Travel routing
5.11 Engineering applications
5.11 Text to Speech
5.08 Music player
5.00 Photo mosaics
5.00 Photo viewer
5.00 Smart appliances

Encryption

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Engineering applications

Text to speech

Music player

Photo mosaics

Photo viewer

Smart appliances

Connect four

Tic-tac-toe

Personality typing

Daily Jumble

Medical diagnosis

Language translation

Both liked

Males liked

Females liked

Females and class liked

Share

- Examples/Assignments you use

- Archeology
- Satellite/Space Applications
- Rocket propulsion needed to leave earth's atmosphere
- Simulation of physics problems
- Weather forecasting
- Web Design
- Search engines
- Peer to peer networking
- Online testing
- Robotics
- Real time sensor/activity programming
- Smartphone apps
- AppInventor
- Artistic analysis
- Electronic text books
- Matrix applications
- Truth vs Validity
- Timing traffic lights
- YouTube assignments or labs
- Replace duplicate files on a volume with links
- Game programming
  - Craps
  - Slot machine
  - Card matching with pictures
  - Timer games - Click and wait (e.g. Shakes and Fidget)
  - Yahtzee
  - Jeopardy
  - Guessing game
- Accounting concepts
- Projected savings by age
- Compounded interest
- Information management systems
- Library book circulation

Share

- How you make a positive environment

Share

- What will you change?
- What should others copy from you?
- What should you change, but will not?

Summary

- CS1X: privilege, baby steps, interesting examples, reinforcement, sociability
- Female- and minority-friendly
- Attracts all students