Changes in CPSC 121:
Towards a coherent picture of computation

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What is CPSC 121?

- Introductory course on discrete mathematics, proofs, logic, digital circuitry and models of computation for first-year CS students
- Prerequisite for second-year theory and systems courses
- 4-credit course with weekly labs
- Lectures have tended to focus on theory; labs on hardware

Background information

- Focus groups and feedback from students and teaching staff has long identified a perceived disconnect for the students between the labs and lectures
- Starting in 2008W2, we began work on restructuring labs to reintegrate them into the course as a whole
- This work has been continued in 2009W1 and 2009W2

Creating an Overarching Story

- Beginning in 2008W2, the “big picture” of a working computer was introduced
- Theory units were tied into how we understand this computer; hardware units were tied into the components of the computer
- First and last labs of the year were focused on simulating such a computer

Format of the Labs

- Two lab hours per week
- Pre-lab exercises to be done at home
- Two TAs (typically one UTA, one GTA)
- Most labs are done with an electronics kit or a circuit simulator
- 9-10 labs a term, covering material such as adders, multiplexers, flip-flops, and regex

Demonstrating applications

- Labs emphasizing the application of course concepts were added, such as new labs on cryptography and information theory; improvements to a lab on regular expressions
- Attitudinal survey data indicates that these labs were the most liked by the students, although some refinements are needed

Streamlining Lab Flow

- Lab manuals were restructured to clarify what needed to be done for a given week
- Pre-labs were put at the start of instructions, bolded, and labeled **TODO (Prelab)**
- Pre-lab completion rates increased
- Lab manual length was also reined in, to decrease time pressures on students and TAs
- Lab completion rates also improved

Student Interaction

- Students are encouraged to work in pairs
- Group work (4-8 students) was added to earlier labs to get students to get to know each other
- Very positive feedback on this from students and TAs (86% of students in a survey reported liking working in pairs; 6% neutral to it)
- Interaction rates highest when working with electronics, lowest on simulation activities

Other changes

- Introducing the role of Lab Coordinator: a TA dedicated to working on the labs
- Weekly lab TA meetings led by the Lab Coordinator to beta test the labs before they are released to students, and train the TAs
- Providing electronics for the students to use, rather than have them buy their own, has improved attitudes

Results from surveying students

- Student attitudes of the labs have improved, but the perceived disconnect remains
- An open-ended, anonymous survey done at the end of 2009W2 about the labs (n=117) yielded answers such as:
  - “Very much so liked the labs. They were often a highlight of my week.”
  - “the labs were super cool and interesting.”
  - “I like the labs as a whole but I feel it needs to be more about the course material.”

Results (II)

- Improvement in how much the students see the labs as well as the pre-labs as contributing to the rest of the course
- Collaboration has increased in the labs
  - “I worked in a pair and it was a great experience. Working in pairs allows us to brainstorm and share ideas.”
  - “Yes, working in a group makes the lab much easier and more interesting.”

Future Work

- Reinforcing the connection between labs and lectures in the lectures
- Improving the quality and clarity of the simulated computer
- Reducing software-related student frustration by transitioning some activities to other media
- Improving the durability and maintenance of the electronics kits available to students