On Teaching Programming Languages Using a Wiki

Iliano Cervesato
Carnegie Mellon University - Qatar

iliano@cmu.edu
CMU-CS 15-212
“Principles of Programming”

- Sophomore-level CS course
  - Advanced programming concepts and skills
  - Introduced in the early 1990s
- Now, little supporting material
  - Notes taken in class
  - Few handouts
  - Code posted on the web page
  - No book!
    - Out-of-print or obsolete
- A challenge for many students

Put the material on a wiki
What’s a wiki, again?

…the stuff of Wikipedia

- Collaborative framework to create (and share) information
  - Simple, transparent editing
    - Supports text, images, math, sounds, ...
  - Topic-oriented
    - Short articles (compared to book chapter)
    - Related topics accessible via links
  - Collaborative
    - Everybody can be an author
    - Mechanisms to avoid abuse
The 15-212 Wiki

➤ Put the whole course on a wiki
  ▪ Categorizes and cross-references material
    • Detailed explanations of material covered in class
    • Lots of examples, exercises
    • Further readings
    • Pointers to advanced material
  ▪ 25% so far (Nov 07 - Jan 08)
  ▪ Built on MediaWiki (same as Wikipedia)

➤ Semi-open for editing
  ▪ 15-212Q staff and students
    • Create, correct, improve articles
  ▪ Experts, instructors, students elsewhere
    • Upon authorization

Very preliminary

1.5 weeks of material
Sample

Code

Graphics

Prose

Formulas
Wiki-Based Instruction

- Not just a surrogate for a book!
- A comprehensive didactic tool
  - Promotes participatory learning
    - Students are “encouraged” to modify articles
      - For play, for curiosity, or for points
      - Get them to research topics
      - Explain ideas to others (in writing)
    - Active participants in the didactic process
  - Easy monitoring of students’ involvement
    - Every edit is logged
      - We know who did what
    - Every access is logged
      - Make sure students read the material before class
        » More interactive and focused in-class discussion
        » No “guest account”
Actual Experiments

- 1 recitation on wiki editing
- 20% of 1st assignment
  - Objective 1: play with the mechanics of the wiki
  - Objective 2: test research/creativity

Problem 4: The 15-212 Wiki [10 Points] Due by Tuesday, January 22nd

This part (and only this part) will be done with a partner. At recitation 2 on January Sunday 20th, you will be introduced to the 15-212 wiki. As an assignment, you will have to write a wiki page on a given topic. One of these topics will be assigned to you:

- **Strings and Boolean**: You work will be to write something about String and Boolean in the same way that it has been already done for Integers and Reals.

- **The Standard ML Basis Libraries**: You work will be to introduce what are the ML basis libraries and briefly describe the most useful ML libraries.

- **SML Top Level Environment**: You work will be to explain what is natively defined in the SML Top Level Environment.

- **ML Compilers**: Your work will be to write a short summary about the other existing ML compilers and their differences with SML/NJ.

8 students

- Group A
- Group B
- Group C
- Group D
Group A

- Students followed models rather accurately
  - Took good advantage of wiki
  - Good starting point

- Some humor

- Little creativity
  - Shy to experiment
Group A (2)

- Same structure
  - Was partially given

- Lot less prose
  - Ran out of time?
    - 2nd week of class
Group B

- These students looked up the material and reported on what they found
  - No elaboration
  - Not integrated within wiki
  - Limited use to other students

- Could have written more
Group C

- Students did research and found several relevant documents
  - Good analysis/synthesis work
  - Combine prose and code as appropriate
  - Reference sources

- Lots of humor and creativity
  - Text at the top of the page
  - Cartoon

- Best result
Group D

- Students did a search on the web and dumped what they found
  - Little post-processing
  - No creativity, no fun

- I was not too happy about this one
Outcome Summary

- **Objective 1: play with mechanics of wiki**
  - All figured out the basics
  - Some did a little extra
  - None did more than expected

- **Objective 2: test research/creativity**
  - Research varied from vigorous web search to minimum needed to adapting example
  - Creativity ranged from the dull to the surprising

- **Altogether**
  - Students found exercise fun
    - Novelty
    - Not usual routine
The Wiki and 212’s Future

- **Categorization helps focus on the big picture**
  - What the course is about
    - Problem solving, not ML

- **Encourages rearranging material and delivery**
  - Experiment with what works best
    - Case-studies, examples, exercises
    - Interplay between problem solving and programming

- **Encourage exploring syllabus improvements**
  - Add/remove topics
  - Change language

- **A more dynamic course**
Future Developments

- Add rest of course material
  - ... my summer project
  - Continuous improvement cycle

- Extend with “try-it” capability
  - Sandboxed interpreter within wiki

- Pair-up exercises with e-tutor
  - Intelligent learning system

- Explore opportunistic learning ...
Opportunistic Learning

- **Books, notes often modeled after lecture**
  - 1+ hour long
    - Long attention span
  - Mostly linear presentation of material
    - This is not necessary and probably not efficient

- **Wiki breaks away from this model**
  - Brief topic-oriented articles linked together
    - Smaller time granularity for studying/reviewing (5-20 min)
      - Harness “dead times” (commuting, time between classes, ...)
    - Focus on actual dependencies
  - Make it mobile
    - Reformat wiki for viewing on PDAs, smartphones
    - Add matching video segments of lecture, slides, ...