

The role of closed laboratories in teaching CS1

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For the programming part of CS1, I find that students learn best if the time used in closed labs is set up for them to read, execute, modify and extend existing code. This is based on the following idea.

We usually learn best and most naturally by doing and sometimes working with others. When learning a foreign language we repeat sounds spoken by others, mimicking inflections and volume, and making lots of mistakes. We learned our first language almost entirely this way from our parents and others. By the time we entered school we not only had developed a large vocabulary, but also had a grasp of grammar and how to formulate ideas in our language. I try to use the laboratories in CS1 in this same way. They are designed to give the student an opportunity to learn by doing, mimicking, making mistakes, and doing again. Each lab needs to be designed so that it begins with a complete program that solves an interesting problem. It must be written in such a way that the student can understand it without going into all of the details. It must also be designed so that the student can modify and extend parts of it without an inordinate amount of effort. In this way they are able to see how to build a new program based on an existing set of code. They have a model of good code in front of them to work with. I also try to have each step of the lab be such that it requires the student to look into a part of the existing program, say one of its classes, and understand it well enough to modify it, extend it or mimic it for another class. This way they don't feel that they are starting from scratch all the time.

Programming assignments of the course are chosen in such a way that the student is able to see that much of the assignment can be solved by using, or modifying, code used and developed in the labs of the previous several weeks. Thus it is important that a series of labs be based on a theme and be coordinated together with the out-of-class programming assignment.

I have also found it valuable to have the students work in pairs while going through the steps of the laboratories. This encourages them to see other ways of solving a problem, to ask questions of each other and to explain what they are doing to another person. Given the discussion of "pair programming" of the past few months, I may try to see how this method affects the work in the closed labs.