The field of computer science is rapidly changing. Over the past several years, there have been many new programs, new concentrations, and new majors (information technology, software engineering, informatics, game programming, computational science, etc.) Despite this new collection of exciting extensions to existing programs, the number of students choosing to major in computing has declined significantly. Both the Taulbee survey and the recent UCLA study have shown a 50-60% drop in the number of incoming students choosing to major in computing. And, the most likely scenario is that without changing plans for recruitment and retention of computing students, the number of students choosing computing will most likely continue to decline. Students taking AP classes in high school often choose to major in the subject in which they have taken an AP course. Despite an increase (from 2001-2004) of 33% of students taking AP tests overall, the number of students taking the APCS exam was down 9% in the A test, and 20% in the AB test, with computing also maintaining the largest gender gap. Continued high attrition in the students' first programming course, means there are going to be significantly fewer students in upper-level courses, and fewer students entering the IT workforce, this at a time that the Bureau of Labor Statistics is expecting a 1.15 million rise in the number of IT jobs over the decade from 2002-2012.

Efforts need to be made to attract more students (especially women and underrepresented minorities) to the various computing disciplines, and to help them to make it through the first year of their computing courses (where the majority of attrition occurs). Attraction of students to the computing discipline needs to occur prior to college, as well as in college itself. Students, starting in middle school, need to be shown computing and computing careers in a positive light. This should occur in curricular, as well as extracurricular settings. The ACM's creation of the Computer Science Teacher's Association (CSTA) is a positive first step towards developing national standards for teaching computing in K-12 education. Support will be needed for implementing their frameworks into courses that can then be replicated across school districts. Outside of school, after-school computer clubs need to be created and supported, and groups such as the girl scouts need to be encouraged to provide opportunities for exposure to computing. Colleges can work with middle and high schools to excite the students towards considering computing. Mathematic departments have been successful in running such events as Sonya Kovalevsky days for girls, and computer science departments could run similar events. Activities such as the CMU road shows will also help to paint computing in a positive light. And professionals involved in computing can encourage students towards computing careers. In addition to the students themselves, guidance counselors need to be educated on the benefits of encouraging students to study computing in college. And professional development needs to be provided to teachers (especially those high school pre-AP and AP teachers) to ensure the quality of their instruction.

Attracting students towards computing also needs to occur in college. This is perhaps best accomplished by creating appealing courses to serve as students' first exposure to computing (and especially to programming). Guzdial has had great success in using multimedia as a hook to excite students about programming. Dann, Cooper, and Pausch have had comparable results in their use of Alice, enabling students to author movies and build computer games as they learn to program. Other novel approaches involve the use of graphical user interfaces (GUIs) and special-purpose graphics libraries, as well as improved development environments to reach students. Novel non-programming introductions to computing also need to be developed and supported. It is important to provide support for such efforts, as well as to assess their effectiveness. It is equally important to ensure that innovations are replicable and are replicated across institutions. And it will be necessary to encourage and support computing departments as they add and/or change introductory courses and grapple with the implications this will have on the rest of their curriculum.

Retention of computing majors in the introductory classes is also important, as the traditional DWF rates in introductory computer science (often as high as 50%) are too high in this environment of fewer students initially choosing to major in computing. Many studies (such as the ones by the AAUW and by Fisher and Margolis) have been conducted trying to determine why students (and women and minorities in particular) have chosen to leave computing as a major. Efforts should be made to implement interventions to combat the causes students have chosen to leave the major.

A particular mention should be made concerning community colleges and the issues of attracting and retaining computing majors. Community colleges play a crucial role in the training of technicians. Attrition runs significantly higher in community colleges, with as few as 1 in 6 students graduating. Community college classes are harder to teach as there is a much wider range of student ability. Also, there are greater needs for faculty professional development (especially with respect to object-oriented programming).

In proposing curricular innovations to introductory programming courses, a concern is that such innovations are unlikely to be aligned to computer science education theory, since computer science education theory is not sufficiently mature to answer many important questions. Questions such as those concerning students' mental models of objects and object oriented programming, relations between a student's style of learning and what style of material presentation/assignments are best suited to that student, and even how to assess mastery of content are all valid questions to which we do not know the answer. Computer science education research does not have the respect that mathematics education research or that science education research has. It is important to better fund computer science education research, so that curricular and technical innovations can be better tied to the theory. Additionally, providing better funding for computer science education research will help to convince computer science research departments of the validity of such research.

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