

National Center for Women & Information Technology

PROMISING PRACTICES

Media Computation at Georgia Tech (Case Study 1)

Attracting Students through an Engaging Introductory Computing Curriculum



K-12 Education



Undergraduate

The **Media Computation** approach to teaching introductory computing developed at Georgia Tech is being effectively implemented now at over a dozen institutions. The two-course sequence aims to make computing more attractive to a wider range of students, especially women, by focusing on computing in an interesting context that is relevant to students' everyday lives. The purpose in developing the course was to solve problems that, in studies, were shown to drive away students from computer science, by:

- making course content *relevant* to non-CS majors
- emphasizing *creative* opportunities in computing
- fostering a positive *social climate* in the class

Like traditional introductory courses, the two-course sequence introduces computing concepts and data structures in a context of creating and manipulating media. For example, in Introduction to Media Computation, students learn about loops by creating picture negatives or reversing sounds, learn about conditionals by implementing red-eye removal and edge detection, and learn about string processing by writing programs that pull information out of web pages. In Representing Structure and Behavior, students experience linked lists, trees, stacks, and queues by creating animations through continuous and discrete event simulations.

Multi-year evaluation results of the Media Computation approach have been encouraging:

- Retention has improved dramatically, from a 72% success rate (earning an A, B, or C) to an 85-90% success rate in both courses. The introductory course is about 300 students per semester and has a 51% female population. The second course was 75% female in its first offering.
- Women in the media computation course are more likely to report that the course is relevant to their lives than are women in the traditional first course.
- Women report finding the course to be creative, with a rich social context supported by an online environment for sharing media.
- The course changes students' perceptions of computing and computer scientists.



- Comparable effects on retention and attitudes toward computer science also were shown at Gainesville College (a two-year public college in northern Georgia).

A challenge to securing faculty adoption of the sequence is that its goal is not to produce software developers. Even in courses explicitly for non-CS majors, many computing faculty want to emphasize standards for good programming rather than more domain-specific computing skills or more general concepts of computer science. However, students report that many of their learning experiences are powerful for helping them think about what computing can provide in their domains.

A key element in the success of the first course is making assignments open-ended and providing an online web space for students to share their media. Most adopting schools have used assignments like the collage assignment, which allows students to use their own media in their own designs. Adopters who have then provided students with a place to share their collages (as well as other images, sounds, and movies) have had similar outcomes to those of Georgia Tech. Adopters who use open-ended assignments but don't provide a place to share the media have not always seen the same improvements in retention.

RESOURCES

Research papers, curricular materials, and implementation suggestions for the Media Computation approach can be found at <http://coweb.cc.gatech.edu/mediaComp-plan>. Margolis, J. & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. Cambridge, MA: MIT Press. The Joint Task Force for Computing Curricula (2005). *The overview report including "The Guide to Undergraduate Degree Programs in Computing."* http://www.acm.org/education/curric_vols/CC2005-March06Final.pdf

NCWIT offers practices for increasing and benefiting from gender diversity in IT at the K-12, undergraduate, graduate, and career levels.

This case study describes a research-inspired practice that may need further evaluation. Try it, and let us know your results.

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PROMISING PRACTICES

How Does Engaging Curriculum Attract Students to Computing? with Case Study 1



K-12 Education



Undergraduate

The content of computing curriculum, especially introductory courses, is believed to contribute to the under-representation of women in information technology (IT). Research suggests that women are more interested in using computing as a tool for accomplishing a goal than they are in the workings of the machine. For example, certain IT instructional programs enroll higher proportions of women than do others. Data from a five-university study showed that women's average representation was lower in computer science than it was in management information systems, informatics, instructional systems technology, and information science/studies, though it was still below parity in these fields. Similarly, reports suggest that women's participation in computing might increase when media applications are used for teaching fundamental concepts (e.g., see the Media Computation approach on the reverse of this page).

In addition to more relevant and meaningful curricula, the greater participation of women in these IT disciplines and curricular programs may be due to the social climate. More women are present, so it is easier to develop an identity as a technical woman in a technical social context. These research findings show great promise for increasing the appeal of computing to women.

Establishing alternate pathways into IT study is another way that female under-representation has been addressed. According to Margolis and Fisher in their 2002 book, *Unlocking the Clubhouse*, introductory courses at Carnegie Mellon University that were tailored to different experience levels resulted in higher satisfaction for both more and less experienced students and for both male and female students.

Special accommodations for women? No. Most educational research shows that interventions that are better for women are also better for men. For example, collaborative learning environments lead to improved learning outcomes for all students, not just women. And bridge courses make it possible for a much larger and more diverse pool of students to "try out" computing, beyond those who elected to take computer science in high school.

MAKING IT MEANINGFUL

Educational researchers emphasize the importance of linking educational materials and curricular programs to students' existing knowledge and experiences. When class syllabi list topics and assignments that focus on unfamiliar concepts with limited, if any, relationship to a student's life experience or interests, she or he is unlikely to take that class. Under the existing educational policy of election, computing is rarely required in secondary school. This means that students are likely to have a narrow and inaccurate view of what IT study involves, what careers are possible, or what kind of people "do" IT. Given the very small proportion of females who study computing in high school, this means that females are less likely to choose IT in college.

The challenge to educators at all levels is to develop engaging assignments and curriculum that can appeal to a variety of students with different learning styles, interests, socio-cultural backgrounds, and abilities while maintaining the rigor of the discipline. Putting the concepts of computing in appealing contexts and building on existing competence can reduce the barriers of entry and level the playing field for those with limited experience.

As the Joint Task Force for "Computing Curricula 2005" points out, computing is no longer a monolithic area of study. The different curricula of the "family of computing-related disciplines" (p. 1) should be studied for their potential to attract high-quality male and female students and produce highly qualified computing professionals.

RESOURCES

Cohoon, J. M. & Aspray, W. (2006). A critical review of the research on women's participation in postsecondary computing education. In J. M. Cohoon & W. Aspray (Eds.), *Women and Information Technology: Research on underrepresentation*. Cambridge, MA: MIT Press.

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