Special Session

Rediscovering the Passion, Beauty, Joy, and Awe: Making Computing Fun Again, continued

Daniel D. Garcia (moderator)
University of California, Berkeley
777 Soda Hall
Berkeley, CA 94720
+1 510-642-9595
ddgarcia@cs.berkeley.edu

Robb Cutler
Computer Science Teachers Association
2 Penn Plaza, Suite 701
New York, NY 10121
+1 408-588-1544
robb@nne.net

Zachary Dodds
Harvey Mudd College
301 Platt Boulevard
Claremont, CA 91711
+1 909-621-8225
dodds@cs.hmc.edu

Eric Roberts
Stanford University
Department of Computer Science
Stanford, CA 94305
+1 650-723-3642
eroberts@cs.stanford.edu

Alison Young
UNITEC
Private Bag 92025
Auckland, New Zealand
+64 9 8154321 x6040
ayoung@unitec.ac.nz

Categories and Subject Descriptors
K.3.2 [**Computer and Information Science Education**]: Computer science education

General Terms
Experimentation

Keywords
Computer science education

1. SUMMARY

At the SIGCSE Symposium in 2007, the ACM Education Board organized a well-attended special session exploring the crisis in computing education and its underlying causes [2]. The idea behind the session was to provide a forum at which a larger and more broadly representative subset of the education community could engage in direct dialogue with the members of the ACM Education Board and Education Council, who are charged with developing educational policy for the ACM as a whole. Last year, we extended that dialogue and explored concrete strategies for emphasizing the "passion, beauty, joy, and awe" (PBJA) of computing [3] about which Grady Booch spoke so eloquently in his 2007 keynote address [1]. The extremely positive feedback we received served as motivation to continue the discussion this year, to allow us to hear from new voices and receive updates on the current state of the crisis. It is increasingly clear that students today find less joy in the process of creating software than their predecessors did a generation ago. At the same time, these skills have become increasingly important, forcing companies to cast an ever widening net in their search for people with the necessary skills and training. Continued progress in the computing disciplines—and indeed the economic health of a society that relies increasingly on computing technology—can continue only if we can encourage an even larger number of students to pursue the many opportunities that careers in computing provide.

SIGCSE'09, March 3–7, 2009, Chattanooga, Tennessee, USA.
ACM 978-1-60558-183-5/09/03.

2. BACKGROUND
The steady decline in enrollments and the even more precipitous decline of secondary school students in the field leaves little doubt that companies, seeking as they are to hire ever increasing numbers of talented employees, will soon face a serious shortage of people with the necessary skills. In 2007, and again in 2008, the situation has improved to some extent. Many universities—including the top research universities in the United States—continue to report enrollment increases. While the numbers are far short of their peak in 2000, this encouraging trend offers some hope that the worst of the crisis may be behind us.

That said, many students are still turned off to computing long before they graduate from high school. Often, this is because they have come to think of computing as little more than word processing and web browsing, offering few opportunities for the excitement that has always attracted people to computing.

In all environments—secondary schools, universities, and companies—it is important to make it clear that computing offers intrinsic excitement that is difficult to match in other disciplines. That excitement, however, comes primarily from the intellectual challenge of solving problems and the engineering challenge of building things that work. To the extent that our discipline becomes associated with applications at the secondary school level, the minute details of some programming language at the university level, or the task of maintaining long outdated code in the workplace, that sense of excitement will be harder to achieve. Only by working together can we address the broader dimensions of this interconnected problem.

As was true in last year's special session, we expect each presenter to take between five and ten minutes to present their own ideas as to how we can help the next generation of students

rediscover the PBJA of computing. The remainder of the time will be devoted to discussion about these issues, of fundamental concern to us all.

3. AUDIENCE AND EXPECTATIONS

The intended audience for the special session is the broad community of computing educators. Almost all of us have been affected in some way by declining student enthusiasm, but these issues are of particular importance to high-school teachers who face many of the same problems, usually with fewer resources to address them. By engaging in broad dialogue, we hope that we can identify a set of constructive initiatives for ACM to undertake.

4. ROBB CUTLER

Students are exposed at an increasingly younger age to technology, both in school and at home, and they use a wide range of computational tools daily. Unfortunately, they do so without truly understanding the potential and power of these tools, as formal education in computer science for the K-12 age group has not kept pace with technological change. Furthermore, with the upcoming elimination of the AB version of the Advanced Placement Computer Science exam, the future of K-12 computer science education is in serious jeopardy. I will talk about the importance of introducing students at an early age to the PBJA of computer science and computational thinking and outline practical ways in which this vision can be accomplished.

5. ZACHARY DODDS

The educational adage, "what is learned is the square root of what is taught," applies as much to computer science as any field of study. In order to stay on the advantageous side of that equation, we have inverted CS1 to present not a field of 10,000 facts, but a crucial fraction of many meaningful human endeavors today. From the excellent curricula of Sedgwick, Guzdial, and others, we have borrowed computational contexts that speak to the passions of as many students as possible in our introductory CS course. Many of these applications relate to mathematics, science, and engineering, because those are common student interests.

We have been surprised by one of the quantitative results of our CS1 student surveys: students' perception of the "worthwhileness" of their computational efforts is well correlated with the perceived difficulty of those tasks ($c > 0.8$). We suspect that difficulty per se does not create worthwhile experiences–if so, education would be a far simpler endeavor! But there may be something to the converse. By emphasizing student choice and relegating details as means to an end, our new CS 1 has increased student engagement with CS broadly while also prompting more hands-on computational thinking, i.e., programming. Perhaps even more importantly, it has re-energized in us (as instructors) the beauty and joy of our field, and the awe of our students' capabilities. The cliché that "educational experiments are doomed to succeed" ends up having a very simple–and positive–message: *Keep experimenting!*

6. ERIC ROBERTS

In recent years, industry leaders in computing have complained that it is difficult to find the people they need because too few students are choosing to pursue computing-related majors in universities. At the same time, most of the top companies hire only a very small percentage of their applicant pool–a policy that initially seems at odds with the notion of a labor shortage. The typical software company is looking for people with unusually high levels of skills and creativity, because those are the employees one needs to create a successful product.

Unfortunately, such people are extremely rare and tend to have temperaments that make them closer to software "artists" than to workaday software engineers. Most computing curricula, however, focus on producing graduates with a specific set of measurable skills. Although acquisition of skills must be part of the training of any artist, academic programs that seek to inspire creative brilliance look quite different from those that one finds in traditional engineering education. If we want to produce software artists, it might be useful to experiment with alternative educational strategies similar to those used to prepare artists, writers, and musicians. Such programs are likely to be more effective not only in producing the kind of graduates the industry seems to want but also in attracting students to the discipline.

7. ALISON YOUNG

As stated in last year's special session: "It is important to make it clear that computing offers intrinsic excitement that is difficult to match in other disciplines". While this is still absolutely true, we are now teaching a whole new generation of students, Gen-Y (or e-Gen as they are being called). This new generation of students has not only grown up with televisions, mobile phones & computers, most of them don't know what a VHS tape is. It is imperative that to inspire this new generation of student and show them the PBJA that we as their teachers understand, we need to ensure that we are aware of our new generation of students learning behaviors' and preferences. To enable us to relate to our students and show them the passion, beauty, joy and awe that *we* have experienced, lets find out what turns them on and relate to them in their way, that way they can experience their own PBJA of computing.

8. REFERENCES

[1] Booch, G. 2007. Readn', writ'n, 'rithmetic..and code'n. In *Proceedings of the 38th SIGCSE Technical Symposium on Computer Science Education* (Covington, Kentucky, USA, March 07 - 11, 2007). SIGCSE '07. ACM, New York, NY, 197-197. **http://www.booch.com/architecture/blog/artifacts/Reading%20Writing%20Coding.ppt**

[2] Cassel, L., McGettrick, A., Guzdial, M., and Roberts, E. 2007. The current crisis in computing: what are the real issues?. In *Proceedings of the 38th SIGCSE Technical Symposium on Computer Science Education* (Covington, Kentucky, USA, March 07 - 11, 2007). SIGCSE '07. ACM, New York, NY, 329-330. **http://doi.acm.org/10.1145/1227310.1227426**.

[3] McGettrick, A., Roberts, E., Garcia, D. D., and Stevenson, C. 2008. Rediscovering the passion, beauty, joy and awe: making computing fun again. In *Proceedings of the 39th SIGCSE Technical Symposium on Computer Science Education* (Portland, OR, USA, March 12 - 15, 2008). SIGCSE '08. ACM, New York, NY, 217-218. **http://doi.acm.org/10.1145/1352135.1352213**