

# Rediscovering the Passion, Beauty, Joy, and Awe: Making Computing Fun Again, part 7

Daniel D. Garcia (moderator)  
University of California, Berkeley  
777 Soda Hall  
Berkeley, CA 94720  
+1 (510) 517-4041  
ddgarcia@cs.berkeley.edu

Jennifer Campbell  
University of Toronto  
Department of Computer Science  
Toronto, ON Canada M5S 2E4  
+1 (416) 978-6320  
campbell@cs.toronto.edu

Rebecca Dovi  
Patrick Henry High School  
12449 W. Patrick Henry Rd.  
Ashland, VA 23005  
+1 (804) 365-8000  
dovimath@gmail.com

Cay Horstmann  
San José State University  
Department of Computer Science  
San José, CA 95192-0249  
+1 (408) 924-5060  
Cay.Horstmann@sjsu.edu

## Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]:  
Computer science education

## General Terms

Experimentation

## Keywords

Computer science education, online learning

## 1. SUMMARY

In his keynote at SIGCSE 2007, Grady Booch exhorted us to share the “passion, beauty, joy and awe” (PBJA) of computing [1]. This led to a series of room-packed sessions at the following six SIGCSE symposia to explore that idea from different angles [2-6]. They have provided a forum for sharing:

- **What we’ve done:** Highlighting successful PBJA initiatives the presenters have undertaken or seen and wish to trumpet.
- **What we should do (curriculum):** Pointing out where our curriculum is lacking in PBJA, and how to fix it.
- **How we should do it (pedagogy):** Sharing how a change in attitude / focus / etc. can make strides to improving PBJA.

While the initial PBJA sessions evolved from a need to understand and combat the enrollment crisis of eight years ago, we are now seeing an incredible resurgence in interest in our field, partially because “coders are hip and computer science is hot” [9]. There are colleges where the numbers have exceeded historic highs, and some rightfully claim the crisis is over [8]. This PBJA “movement” was born out of this enrollment crisis, but is not tied to it [7]. There is always value in sharing novel best practices and advocating techniques that make computing fun for beginners.

In the past, we either tried to gather educators who brought a wide variety of perspectives, who would focus on a particular

issue, or who have instituted very creative and successful paths into the major. This year we have gathered three seasoned educators who have taken the leap and built online classes for introductory computing on three different platforms. What innovative ideas did they employ to support collaboration? Does the need to auto-grade mean students can no longer choose their own final projects, and how does that stifle PBJA? Do these auto-graded formative assessments feel like drill-and-kill? The hope with this panel is to explore how online offerings, in these crucial early years, extol (and perhaps suppress!) the PBJA of computing.

## 2. JENNIFER CAMPBELL

In Fall 2012 and Winter 2013, I co-developed and co-taught (with Paul Gries) two MOOCs on introductory programming in Python hosted on *Coursera*. We re-offered the first MOOC in Fall 2013. To date, there are over 270,000 registrants in our live and archived courses. Together, the video lectures for the two MOOCs correspond to our 12-week on-campus CS1 course.

For some learners, the MOOC experience is one of PBJA and we witness that on the discussion forums where “Aha!” moments are celebrated, mentor-mentee relationships are fostered, and gratitude is expressed. But it isn’t all positive and some learners express confusion and frustration. Participants on the discussion forums represent only about 5-10% of those enrolled, so we don’t know how the rest are experiencing the course.

For some, the opportunity for a PBJA experience seems to hinge largely on community and communication. Learners need the right support at the right times. A few practices that we view as key are: sending regular emails to support and encourage our learners, addressing problems promptly and communicating the outcome to learners, having a regular instructor presence on the discussion forums, structuring the discussion forums in a way that makes it simpler to navigate and minimizes duplication, and finally, for repeat offerings, inviting select former MOOC learners to serve as moderators.

### 3. REBECCA DOVI

In the summer of 2013, I developed the curriculum and recorded the lessons for the AP Computer Science MOOC to run through the 2013-14 school year. The goal was to provide a course geared toward high school students in preparation for the AP CS exam. To our knowledge, this was the first MOOC specifically designed for a K-12 audience. Currently, fewer than 10% of American high schools offer the AP CS course, so most students in the United States do not have access to the course in a traditional classroom setting.

Due to the age of the targeted group, several modifications to the traditional MOOC structure were made. The course was divided into two terms, beginning in early September and ending in early May. Course materials were also structured with this age group in mind, with each lesson containing a warm up, 2-5 video lectures, graded multiple choice and code questions, and independent practice problems. One of the biggest challenges has been adapting the AP style free response questions to the MOOC environment.

The MOOC itself was tiered into two groups. Anyone could enroll and follow the MOOC for free. The second option, *MOOC local*, trained a local adult to act as a coach for the students. The students met in person with this coach about once a week. There was a separate interface for these coaches that provided training and support materials, as well as a grade book interface to monitor student progress. We feel it was the human contact and 1-on-1 support the coach provided that really helped support the PBJA.

For the 2013-14 school year the MOOC was run as a free pilot. In future years the plan is to continue to run the public MOOC for free and charge a fee for the MOOC local access. This would allow students to get high school credit for the course. The fee system is similar to many of the Virtual School programs available in public schools throughout the country, with the primary difference being the support of the local coach.

### 4. CAY HORSTMANN

In Spring 2013, I designed and recorded a CS1/Java course with Udacity that was designed to be a complete equivalent to our brick-and-mortar class at San José State University. The course was offered for college credit in Summer 2013, taught by my colleague, Kathleen O'Brien, with about 800 registered students and over 15,000 MOOC participants who didn't take the course for credit. It will be revised and repeated in Spring 2014.

We struggled mightily to inject a measure of PBJA into what can be a rather dull environment. Here are some of the practices that I think worked out well. (1) Multiple lecturers with different personalities. A Udacity staff member, Sara Tansey, recorded about half of the material, focusing on worked examples, and we constantly switched back and forth. Several Stanford students made cameo experiences, telling students it was normal to be confused and frustrated, and how it all works out in the end. (2) Very short videos. The target for each video was 2 minutes, immediately followed by a question (mostly programming exercises and a few fill-in/multiple choice), followed by an even shorter answer video. Repeat ad infinitum. (3) Engaging examples. I was given strict orders to avoid prime numbers and digits of  $\pi$  since, in Udacity's experience, one loses students quickly when the exercises don't interest them. We did a lot of work with image manipulation since it was visually interesting and worked well with the autograder. (4) A good autograder that

allows quick authoring of hundreds of programming exercises. Instead of explaining students how to build up a complex example, we let them do the work, a programming problem at a time, changing a few lines of code here and there. I learned never to tell when I could ask.

But today's technology is still very primitive, and we just scratched the surface of what can be done. In particular, social aspects are almost entirely lacking. The discussion forum is a noisy mess. There is no way for students to showcase their own creative work. In my view, scaling from individual to collective PBJA is the next challenge of MOOC platforms.

### 5. REFERENCES

- [1] Booch, G. 2007. Readn', writ'n, 'rithmetic... and code'n. *SIGCSE Bull.* 39, 1 (Mar. 2007), 197-197. doi.acm.org/10.1145/1227504.1227380
- [2] Garcia, D. D., Cutler, R., Dodds, Z., Roberts, E., and Young, A. 2009. Rediscovering the passion, beauty, joy, and awe: making computing fun again, continued. In *Proceedings of the 40th ACM Technical Symposium on CS Education* (Chattanooga, TN, USA, March 04-07, 2009). SIGCSE '09. ACM, New York, NY, 65-66. doi.acm.org/10.1145/1508865.1508889
- [3] Garcia, D. D., Chapman, G., Hazzan, O., Johnson, M., and Sudol, L. A. 2010. Rediscovering the passion, beauty, joy, and awe: making computing fun again, part 3. In *Proceedings of the 41st ACM Technical Symposium on CS Education* (Milwaukee, WI, USA, March 10 - 13, 2010). SIGCSE '10. ACM, New York, NY, 394-395. doi.acm.org/10.1145/1734263.1734399
- [4] Garcia, D. D., Hutton, M. F., Lemon, E., and Paley, J. 2011. Rediscovering the passion, beauty, joy, and awe: making computing fun again, part 4. In *Proceedings of the 42nd ACM technical symposium on Computer science education* (SIGCSE '11). ACM, New York, NY, USA, 613-614. doi.acm.org/10.1145/1953163.1953332
- [5] Garcia, D. D., Ericson, B., Goode, J. and Lewis, C. 2012. Rediscovering the passion, beauty, joy, and awe: making computing fun again, part 5. In *Proceedings of the 43rd ACM technical symposium on Computer Science Education* (SIGCSE '12). ACM, New York, NY, USA, 577-578. doi.acm.org/10.1145/2157136.2157300
- [6] Garcia, D. D., Barr, V., Guzdial, M. and Malan, D.J. 2013. Rediscovering the passion, beauty, joy, and awe: making computing fun again, part 6. In *Proceeding of the 44th ACM technical symposium on Computer science education* (SIGCSE '13). ACM, New York, NY, USA, 379-380. doi.acm.org/10.1145/2445196.2445308
- [7] 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. doi.acm.org/10.1145/1352135.1352213
- [8] NY Times. *CS Programs Make a Comeback in Enrollment.* www.nytimes.com/2009/03/17/science/17comp.html
- [9] NY Times. *Giving Women the Access Code.* www.nytimes.com/2012/04/03/science/giving-women-the-access-code.html