Rebooting Competitions: Reviewing, Recalibrating and Reimagining Public Events for Supporting Computing Education

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National and local competitions such as Coding Wars, Google Science Competition, FIRST Robotics, Hackfest, Microsoft Imagine Cup—to name just a few of the ever growing list—have become popular venues to highlight application and hardware designs. In recent years, online versions such as the National STEM Video Game Design Challenge, Globaloria Awards, and Make2Learn Contest, have joined the portfolio. While such public events starting with science fairs have a long tradition, the first National Science Fair was in Philadelphia in 1910, the increasing number of these public competitive events is a fairly recent development to inspire students in K-16 to excel in math, science, engineering and computing. Public events, where students prepare, display, and share their artifacts, are widely believed to be a valuable learning experience (e.g., Abernathy & Vineyard, 2001; Grote, 1995; Yasar & Baker, 2003). Participation, often encouraged with support from teachers or parents, is highly correlated with later career choices in STEM majors (Forrester, 2010).

As the numbers of online and offline competitions are proliferating, little is known about how they could be designed to better increase learning opportunities, to what extent they are successful in broadening participation, and what alternative arrangements exists that could recognize computing designs. Future CS Education research should target this important and very visible area of acknowledging and celebrating computing accomplishments focusing on the following aspects:
(1) Reviewing the dimensions of competitions to amplify levels of youth participation and learning: Online competitions such as the 2012 National STEM Video Game Design Challenge (http://stemchallenge.org) invite students to program games with STEM content and upload them whereas the 2013 Make-2-Learn Youth Contest invites youth to share and explain physical rather than virtual designs for the possibility of garnering one of the prizes in different grade levels (http://m2l.indiana.edu/make-to-learn-challenge/). We have different opportunities, online and offline, with virtual and tangible impact but it is unclear how those competitive designs engage youth in computing. What are some of unique challenges of using video games as a way to attract more children to computing, including attracting a greater number of females to such elective coursework? How can we push for more endogenic (rather than exogenic) integration of content in these computing designs? How can we ensure that fostering a spirit of competition among students also leads to utilizing each other as resources for more authentic audiences and peer-to-peer collaboration? For those events that focus on tangible designs, how do we make potential connections to learning more explicit? Can we design competitions that promote learning goals and stay connected to maker culture? How can we facilitate the sharing of tangible designs? Can we move from robotics to include other materials such as electronic textiles (Buechley et al., 2013) in competitive designs?

(2) Recalibrating competitions to be more equitable in participation. At the same time, little is known about which aspects of these competitive events motivate and sustain youth participation. Although actively engaging many youth, to date, large-scale competitions have often encountered difficulties attracting and sustaining participation for students in groups traditionally under-represented in technology careers (e.g., FIRST LEGO League, 2008-9; Greenfield, 1995). Research on achievement motivation suggests that an emphasis on performance and competition may be most motivating to students who already have high confidence in their ability (see review by Kaplan & Maehr, 2007). Furthermore, while competitions are theoretically open to all, it is unclear to what extent they are broadening participation—an issue central to any outreach effort. How can we get better information about participants in these competitions, especially those who do
not join? What are better ways to extend recruitment for bringing in more diverse groups of participants? What models of competitions and activities appeal to which groups?

(3) **Reimagining new models of competitions and collaborative designs in computing.** Some research should also focus on public events that are more collaborative than competitive in nature. For example, Rusk and colleagues (2008) present examples of organizing robotics exhibitions as an alternative to robotics competitions. Other events such as the 2011 Scratch Collab Challenge ([http://info.scratch.mit.edu/collabchallenge](http://info.scratch.mit.edu/collabchallenge)) initiated collaborations between online members to program a Scratch project by using three different elements. Further iterations promoted the idea of Scratch Collab Camps rather than Challenges to recruit more participants. The 2013 eCrafting Circles ([http://ecrafting.org](http://ecrafting.org)) are a hybrid of online calls that bring local community groups together in making physical artifacts and end in local celebration of designs. Although differing in focus, these more collaborative events still retain the idea of addressing an authentic audience (Magnifico, 2010) but they focus more on sharing of ideas than selecting a winner. It is clear from this short list of examples, that there are many different ways to organize public events to recruit and engage participants. Can we design public events or competitions that start rather than end with highlighting design accomplishments? Can we generate more examples for collective designs, those designs where individual components contribute to a larger ensemble? Are more collaborative models equally, if not more, successful in recruiting diverse participation?

Public competitions have and will continue to play an important part in our culture but we need be aware that they also come with certain constraints in terms of connecting to learning and broadening participation in computing. We need to better understand the continuum of collaboration versus competition and individual versus collaborative productions, all of which can be key dimensions in the design of productive and meaningful learning activities in computing education.

**References**


