Using a Networked Community to Support Equitable Access to Computational Learning | the digital divas

Caitlin K. Martin, Ugochi Acholonu, Nichole Pinkard, Denise Nacu & Jim Sandherr • *Digital Youth Nework & DePaul University College of Computing and Media*

Introduction

An urgent challenge today is the need to develop digital literacy and computational fluency for all young people (Wing, 2011, NRC, 2012). Implications include questions about who will be able to take advantage of the growing number of STEM career opportunities. Despite increased access, the current digital divide is framed in terms of who has the opportunities and support to participate in ways that build competencies and develop interest in STEM disciplines (DuBow, 2011).

We know that adults, including parents and educators can be instrumental in guiding learning and participation in technology projects (Barron, et al, 2010; Kafai et al, 2007). However, in most homes, schools, and community centers, deep technical knowledge is not the norm (e.g. Warschauer & Matuchniak, 2010). Girls and youth from areas of lower socioeconomic status have especially limited opportunities and support, both in and out of school (Margolis & Fischer, 2003; Margolis, 2008).

Networked technologies promise potential solutions, making connections between youth, learning activities, and social learning resources beyond the boundaries of home, school, and local community.

Digital Divas summer program

The Digital Divas 6-week summer program introduced middle school girls to computational making through interest-driven design projects using a blend of online learning resources and face-to-face time.

The online aspect of the program was part of the Chicago Summer of Learning (CSOL), which offered STEM opportunities through 38 online learning pathways. Each online learning pathway included scaffolded design challenges, virtual badges, and networked access to 37 adult mentors, some with computational expertise.

The Digital Divas face-to-face program held weekly 6-hour workshops at the CSOL drop-in computer lab at a central downtown university and required an additional 10 hours of online participation each week. CSOL online learning pathways were selected to cover topics the girls may not seek out on their own blended with those they may be already interested in and familiar with.

Methods

Looking at online participation of the Digital Divas and the larger CSOL population

- *Participants:* 285 youth ages 13-18, 37 adult mentors, and 10 administrators
- *Data:* Online log data of participant actions (N=20,292 logs) on the CSOL site

Focusing in on the Digital Divas program

- *Youth participants:* 37 girls (ages 11-14) representing 18 city zip codes
  - 81% African-American, 12% Latino, 6% mixed race
  - 29% report unreliable Internet access at home
- *Adult participants:* 3 female Digital Divas mentors; 3 female CSOL drop-in mentors
  - 3 African-American, 1 White, 2 Hispanic
  - Digital Divas mentors were not trained in computational subjects, but had extensive experience working with youth and digital media design
- *Data:*
  - *Surveys* of girls' technology access, interests, and experiences (87% response rate)
  - *Retrospective interviews* with mentors involved with the Divas program (N=4)
  - *Collection of program artifacts* (e.g. program blog; session photographs)

Acknowledgements. This work and research is funded by the MacArthur Foundation and a Cyberlearning and Future Learning Technologies grant from the National Science Foundation (REC# 1325004). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of funding organizations.

References

Barron, B., Martin, C. Takeuchi, L. & Fithian, R. (2009). Parents as learning partners in the development of technological fluency. *International Journal of Learning and Media, 1*(2).

Dubow, W. (2011) Pushing toward gender parity in computing in the US, ICERI 2011.

Kafai, Y. B., Peppler, K. & Chiu. (2007). High Tech programmers in low-income communities: Creating a Computer culture in a community technology center. *TTC* 2007.

Margolis, J. & Fischer, A. (2003). *Unlocking the clubhouse: Women in computing*. Cambridge, MA: The MIT Press.

Margolis, J. (2008). *Stuck in the shallow end: Education, race, and computing*. Cambridge, MA: The MIT Press.

National Research Council. 2012. *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Washington, DC: National Research Council.

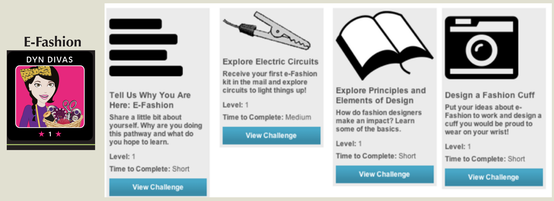
Warschauer, M. & Matuchniak, T. 2010. New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes. *Review of Research in Education 34*(1).

Wing, J.M. (2011). Research notebook: Computational thinking—What and why? *The Link Magazine*, Spring. Carnegie Mellon University, Pittsburgh.

Q: What evidence of learning was documented?

1. Girls in Digital Divas explored more computational learning pathways than the larger CSOL community. The Divas started (submitted at least one piece of work) on almost twice as many different online pathways (M = 4.14, SE = 0.37) compared to the average youth overall (M = 1.62, SE = 0.14), suggesting a broader range of exposure to computational and digital topics (Univariate ANOVA, $F(1,256) = 42.93$, $p < .001$).

Almost one third of the girls (nine) began a learning pathway that was not required for the Digital Divas program, including an architectural design pathway created by the Chicago Architecture Foundation and a Digital Storytelling pathway designed by the Creativity Labs at Indiana University.



2. Girls in Digital Divas submitted more learning artifacts than the larger CSOL community. The Divas submitted an average of 8.86 pieces of work (SE = 0.90) compared to an average of 3.23 submissions (SE = 0.36) for the CSOL youth population at large, suggesting more sustained topic activity (Univariate ANOVA $F(1,256) = 35.57$, $p < .001$).

3. Girls in Digital Divas submitted artifacts that exhibited novel experiences with computational design and making: Few girls reported prior sustained experience with computational projects such as programming (0%) or creating a digital game/animation (3%).

Pathway challenges led girls through stages of design and computational thinking, including paper prototyping and implementing working circuits into design.

Online Mentors: Allowing movement on the system

Q: How were girls supported in their learning by adults both in face-to-face and online environments?

The online system was the mechanism for submitting work and leveling up, requiring knowledgeable mentors who understood the computational content areas.

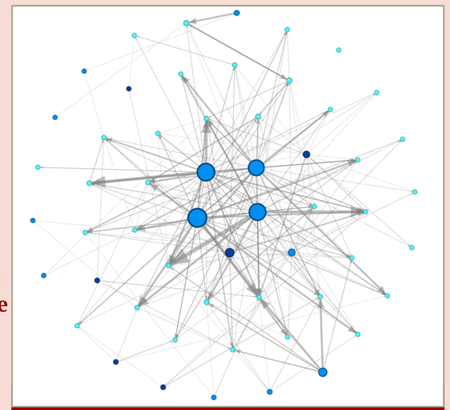
Exploratory social network analysis looked at online interactions between the Digital Divas and mentors (N = 900 logs). Actions included mentors viewing, commenting on, and assessing youth work (including prompts for revision).

In the visualizations, each node represents a person. Color represents user role, and size represents the weighted out-degree.

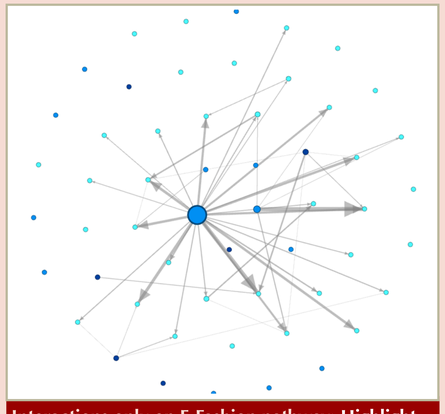
- Youth (girls in the Digital Divas)
- Online-only mentors
- Face-to-face mentors

The girls interacted with 13 online mentors located in three US states with expertise in distributed digital and computational subjects.

The face-to-face mentors exhibit fewer outgoing connections to youth online.



Interactions on all pathways: Reveal four primary mentors, each specialized in a Divas content area. Girls had access to distributed expertise.

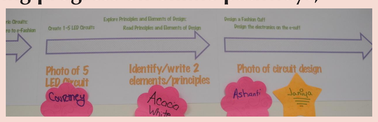


Interactions only on E-Fashion pathway: Highlight the central E-fashion mentor, a curriculum specialist with a focus in computational technologies who assessed work from 300 miles away.

Program Mentors: Encouraging persistence & attendance

Additional mentor-youth interactions occurred in the face-to-face environment that were critical for participation, especially in the areas of encouragement and community recognition.

Making progress visible. Mentors created paper maps visualizing progress on online pathways, posted them on the walls and updated each week.



Distributing extrinsic motivators such as gift cards, lunches, and field trips, when the group reached pathway milestones.

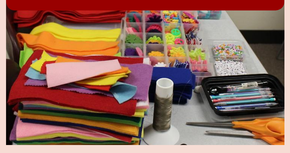
Building community. Mentors strived to create an environment that girls would choose to attend. Each day they convened girls in a circle to share out. A public blog documented their work and experiences over the summer and the friendships that grew.

Monitoring public transport. Mentors accompanied Divas participants to and from the public transportation station near the drop-in center after an incident made one of the girls uncomfortable.

Communicating with families. Mentors checked in with parents if girls did not attend and provided weekly email updates and photographs allowing the parents a window into their child's work and experiences that summer.

"After the first week I added a timeline in the physical space so the Divas could see their entire [pathway] trajectory . . . and where they and their friends were on their journey. I was hoping this would prove to be motivational for the girls."

"Each day was unique in that I wore multiple hats…my role was to teach/mentor/support the participants, create/provide supporting learning materials, …and help the youth with any problems they encountered on a daily basis."



The girls' average attendance was 9.4 sessions, indicating that most girls dropped in beyond the six scheduled Digital Divas sessions.

Implications

The girls' tenacity to voluntarily persist with complex computational learning activities through design projects provides encouraging insights. Specifically, this work suggests that quality STEM opportunities for youth can be offered even in areas without specific expertise by connecting deep support in face-to-face environments with material resources and networked expertise and assessment online. Our ongoing work explores how to design for this in different communities.

digital youth network