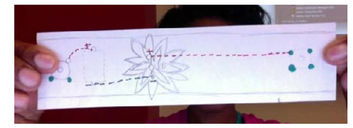
Flip the Switch: Generating Girls' Interest in STEM through E-fashion



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When asked for their opinion on computer science, middle school girls tend to describe the field as being for "boys" and "nerds." The same girls, when asked about the word "diva," describe females of all ages as being sassy, cool, and "just like me!" The Digital Divas program provides fun, innovative computer science and engineering opportunities for girls who don't typically see themselves as tomorrow's tech bosses. We encourage middle school girls to become STEM leaders by bringing them technology with attitude!

Why this work matters

Although STEM career opportunities have increased in number and variety over the past decade, the majority of young women have opted to pursue non-STEM fields of study. In particular, there has been a well-documented drop in the number of women in computer science and engineering courses (Margolis & Fisher, 2002; Margolis, 2008; Klawe, Whitney, & Simard, 2009). While more women are using technology to mediate all aspects of their professional and personal lives, only a narrow slice of women are actively involved in the design and creation processes.

Researchers focused on understanding and closing this gap have identified that a student's interest in STEM is strongly connected to whether or not he or she has been exposed to STEM disciplines in ways they find engaging (Ainley, Hidi, & Berndorff, 2002; Hulleman & Harackiewicz, 2009). Traditionally, we think of school as the vehicle for providing access to STEM learning opportunities; however, research by Goode (2007) and Margolis (2008) revealed that schools serving minority and low-SES students have fewer computer science courses compared to schools that serve middle-class and majority students. Even when there are opportunities, barriers exist such as negative stereotypes and a dearth of role models and community.

Dabney et al. (2012) found that participation in out-of-school STEM opportunities in the middle grades plays a significant role in the pursuit of a STEM major in college. Again, however, there are inequities. Maltese and Tai (2010) found that there is a gender gap in student participation in out-of-school STEM programming, with males reporting more self-initiated, unstructured, and informal science activities.

The Digital Divas program

The Digital Divas program presented in this poster was created to address these issues through the intentional design of environments, materials, and practices for urban girls in Chicago, especially those who were unengaged with STEM learning. The program integrates online and after-school programming and project-based curriculum with the goal of supporting urban girls to develop creative interactive electronics, gain experience, and build confidence to engage and succeed in formal and informal STEM programming alongside a cohort of peers from around the city who share similar interests and skills.

References

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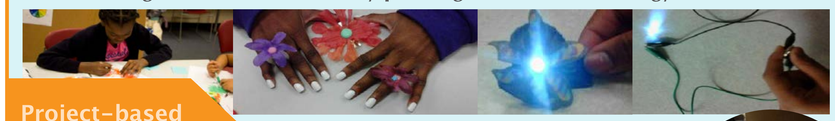
Adult mentors are not engineers, but share cultural connections with the girls and have gone through curriculum and pedagogical training. These young women support and work alongside girls, attending to specific practices of encouraging completion and participation, helping to troubleshoot work, and developing community through circle share-outs, a public blog to document work and experiences, and activities that engage collaboration.

Community of learners

Middle school girls interested in fashion and design recruited from different areas of the city, especially those that have traditionally been underserved. These girls work independently and collaboratively, share stories and experiences, and learn from and teach each other.

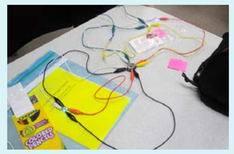
The program combines **principles of fashion and design with possibilities of electronic circuits** to develop the building blocks for the creation of interactive e-fashion (electric fashion). Circuitry concepts are reinforced by allowing girls time to explore, experiment, design, and create. Girls employ basic foundations of fashion design to make aesthetically pleasing wearable technology.



Project-based curriculum

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

Digital Divas
An informal program during unstructured time—summer, after-school, spring break—using overlapping strategies for learning and interest development.



Face-to-face time is scheduled in a central location, including charter schools and university computer labs. In these spaces, girls work through projects in a shared physical space using available materials. Strategies for making progress visible within the physical space include creating paper maps visualizing girls' progress on intended program work. Extrinsic motivators act as shared experiences within the physical space, including gift cards, lunches and snacks, and field trips when the group reaches certain project milestones.

Integrated spaces

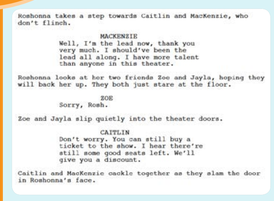
The online system, iRemix, is the mechanism for independent work outside of face-to-face programming, submitting work, leveling up, and communicating with others around projects.

The iRemix platform uses social networking to connect face-to-face and online learning opportunities. Through a system of learning pathways, iRemix intentionally makes learning goals visible by organizing work as a series of scaffolded challenges with corresponding resources. Social network features allow participants to connect with one another, including messaging, commenting on each others' work, and starting discussions.

iRemix Divas interface: Divas have access to content, learning resources, and their project portfolio anywhere they have Internet access. Mentors and peers were virtually connected.

Girls are able to track progress and completion of projects and activities. New opportunities are unlocked based on prior experience and completion.

Compelling stories conveyed in text and multimedia (video, audio, comics, images) are employed to engage middle school girls in activities involving computational thinking. The stories center on a group of middle school girls involved in the Digital Divas program, and combines aspects of contemporary young adult fiction (mystery, clues, social and emotional issues) along with relevant content.



Roshonna takes a step towards Caitlin and MacKenzie, who don't flinch.

MACKENZIE
Well, I'm the lead now, thank you very much. I should've been the star all along. I have more talent than anyone in this theater.

Roshonna looks at her two friends Zoe and Jayla, hoping they will back her up. They both just stare at the floor.

ZOE
Sorry, Rosh.

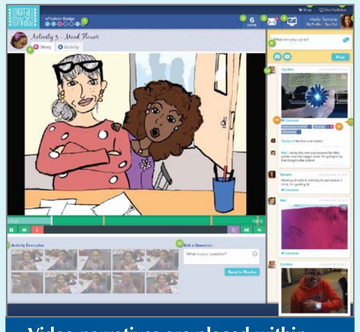
Zoe and Jayla slip quietly into the theater doors.

CAITLIN
Don't worry. You can still buy a ticket to the show. I hear there're still some good seats left. We'll give you a discount.

Caitlin and MacKenzie cackle together as they slam the door in Roshonna's face.

Interactive narrative stories

The interactive narratives unfold through the Divas iRemix platform. Girls have the ability to launch narratives and tools to solve the challenges within the online system by submitting work and responding to characters. An example is when the main character of the narrative, Roshonna, asks for help to solve a color coding mystery. Girls message Roshonna a solution via iRemix.



Youth response: "Hi Roshonna, This is Clementine. I saw your color message and want to help you out. With the help of my color wheel, I interpret this as a message for you to loosen up and stop being so furious with the workings of fate. This chance might be stolen from you, Roshannah, but there are millions of opportunities for you to seize."

Video narratives are placed within the online environment, with activity prompts embedded at different points in the story. Often the activity requests a submission within the site.

Implications and future work

Digital Divas programming has been generative in building community, engaging young girls in project work, and expanding experiences. We continue to develop the narrative methods of interactive implementation on and offline to look at how they influence girls' STEM interest and identity development.

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