Towards Girls' Self-perception in Technology and Craft: Challenges and Implications

Sawaros Thanapornsangsuth, *st2839@tc.columbia.edu*

Nathan Holbert, *holbert@tc.columbia.edu*

Monica Chan, mmc2265@*tc.columbia.edu*
Teachers College, Columbia University USA.

Abstract

This poster explores findings on elementary girls' perception, confidence, and personal experiences in technology and craft. We look into how they define technology and their exposure to technology as consumers and producers. We also asked questions about their experiences with craft materials and activities. Despite coming from families that encourage and financially support extracurricular activities in STEM field, the majority of girls did not feel confident about their knowledge and skills in technology. They also had a tendency to position their own expertise as inferior to their male family members. When asked about crafts the girls showed high interest and engagement and each identified herself as someone who is good with crafts.

Keywords

girls in technology; technology education; craft; technology confidence

Introduction

A large number of articles show that stereotypes and low expectations of women in math, science, and technology play a major role in women's loss of interest in the field (Cohen et al, 2016; Spencer et al., 1999; Steele, 1999). These stereotype threats also contribute to the notion that they are technologically inferior to their male counterparts (Hyde et. al, 1990; Margolis & Fisher, 2003). These data may contribute to gender disparities in STEM professions. The most recent data from National Center for Women & Information Technology (2015) reveals that women make up only 15% of practicing engineers. When technology is described as being primarily for hackers, programmers, and engineers those who do not identify themselves as such are pushed out (Worsley & Blikstein, 2016). Martinez (2015) suggested educators should be sensitive of their classroom environment as girls can react negatively to surroundings that reflect stereotypical "hacker culture" in making, by rejecting their interest in technology and engineering. Literature has suggested creating an inclusive and supportive learning environment and drawing wider examples of what counts as STEM can also help nurture women's interests in these domains (Hill, Corbett, & Rose, 2010; Intel Corporation, 2014; Margolis & Fisher, 2003)

Digital fluency is a concept that has been discussed by many scholars (Kay, 1991; Jenkins, 2006; Resnick, 2012). The perception of being good at technology maps onto the concept of digital fluency, which has been formalized by the National Research Council (NRC), where it states that "people fluent with information technology are able to express themselves creatively" using their chosen technologies (Barron, 2004). Combining the NRC's definition about digital fluency to Resnick's (2012) stance—that true mastery of technology involves being both a confident producer and consumer of technology, we project that if the girls see themselves as a producer of technology, this change in perception might improve their confidence towards their technical abilities. Specifically targeting girls, scholars such as Buechley have explored using computational textiles to bridge the gap between traditional perceptions of technology and craft (Buechley et al., 2008). Crafting techniques such as sewing has a more feminine orientation traditionally, but combining craft and electronics such as e-textiles to cultivate a stronger producer of technology mindset has indicated positive engagement in females toward electronics and computing (Buechley & Eisenberg, 2008).

There is a paucity of research examining the barriers that impede young girls to identify themselves with high competency in technology. Likewise, little work has been done to explore these perceptions for girls from various backgrounds and experiences. This study is a part of the wider Bots for Tots project (Holbert, 2016). We are engaging young learners from diverse communities to build toys for younger kids in their school. In this paper, we explore how girls from privileged backgrounds who have access to high-tech tools and come from well-supported families feel less confident about their technology competency. In examining this population our research aims to answer the following questions: (1) How do the girls describe their experience with and knowledge of technology? (2) What tools, toys, or activities do the girls consider to be "technology?" (3) How do the girls describe their experience with and knowledge of crafts?

Methods

Population and Site

The data presented here is part of a larger Bots for Tots study on fourth grade students (aged 9-11) at a high-resourced all-girls private school in a suburban area in the North-Eastern United States. According to the school's website, 71% of the students are white. Forty-one fourth-grade students participated in the study as a part of their Making and Engineering class, a bi-weekly maker education class which ran 45-minutes per session. Out of the 41 girls, 12 were randomly selected to be interviewed. In addition to the many extracurricular activities and programs available in the school, students in 4th grade and beyond have access to an Engineering and Design lab (EDL) which is filled with cutting edge equipment including a CNC machine, laser engraver,

multiple 3D printers. This population is unique and interesting as they represent the group of girls who receive the best exposures and opportunities to technology. Many of the girls have parents who are engineers, have the opportunity to take extracurricular STEM courses such as robotics and programming, and have access to many high-tech toys and construction kits. Due to their upbringing, these girls are well suited for success in STEM fields. All names used in this paper are pseudonyms chosen by the girls interviewed.

Data Collection and Analysis

Twelve girls were randomly selected to participate in pre and post interview, before and after the Engineering and Design class. Using a semi-structured cognitive-clinical interview format (Ginsburg, 1997), the fourth-grade girls were asked questions about their 1) electronic toys or devices at home, 2) self-perception of technology, and 3) experience with making and crafts, both for themselves and for other people. We did not define technology or provide any specific examples as we sought to understand what the girls regarded as technology. Upon analyzing interview transcripts, we developed a profile for each girl and grouped them in categories and developed a code scheme (Bogdan & Biklen, 2007). This scheme focused on how the girls self-report their "technology and making confidence." Examples included phrases such as "Umm not really," and "My brother like to build [..] but I don't build." We also coded and categorized the girls based on their different craft activities and experience. Example codes include, "girls making crafts", "girls talking about family members", "girls making by or for themselves." After grouping data in coding categories, we reviewed them for thematic connections (Seidman, 2013).

Results

Low confidence in technology and male family members as experts

When the twelve girls were asked if they considered themselves as someone who is good with technology in the pre interview, eight girls showed lack of confidence and said they were not. Answers included: "no," "I don't know," "not that good," "I'm not the expert," and "not really." One girl expressed uncertainty, answering "kind of". Only 3 students indicated that they are good with technology. Out of the 12 girls, 6 girls mentioned male family member such as a dad, brother, or uncle, as someone who is good with technology.

For instance, Betty talked about her extensive experience spending her free time working with electronics and technology. She did not have a phone but she enjoyed assembling and playing with "Meccano" (a sophisticated robotics toy that requires 168 steps to assemble) and building bird houses with her dad who is an engineer. She liked technology and electronics, however, when we asked about her technology competency, she immediately responded "No." She later shared that she did not feel confident as her dad would not let her do the work, "normally he's like doing the whole thing." She often looked at her dad building from behind. Similar to Betty, when Panni was asked about her technology competency, she answered "I don't know" while shrugging her shoulders. Constantly denying her competence with technology or construction ("I'm not a big, big builder") she referred to her brother as a person who fitted the description better: "I don't really build stuff that much. My brother likes to build. If he sometimes gets something to play with, and it doesn't come all together, he can build it. But I don't build much."

The girls also mentioned female family members but not necessarily referring to them as technology savvy. For instance, Aditi told us that if something goes wrong with her electronic devices, she would not go to her mom but will seek help from her dad or brother. Lightbulb said that she could not fix a computer but she often taught her my mom how to use different functions on her phone. Kate was the only girl who referred to a female family member as someone who "very good with technology." She said that she would seek help and learn from her twin sister if she had difficulties with electronics. Additionally, we also learned about the girls' experiences and usage of the technology. The most common use of technology was to play games (6 girls), watch

videos (5 girls), learn an online lesson or do homework (4 girls), programming (2 girls), make videos (2 girls), build a robot (1 girl).

Nine months later, after participating in the Bots for Tots project, we asked them again in the post-interview about their perception of technology. Five of the students said they were good with technology but 2 out of the 5 expressed uncertainty when probed further about their experiences. For example, Kate switched between positive and negative comments about her technology competency, “I feel like working, trying to figure something out either on a phone or computer, I'm pretty good at, I'm not very good. But I think I'm still good.” Similarly, Erica showed a little hesitation and answered “Well, it kind of depends on what kind of technology, but when we were using the circuits during games I think it was great fun.” 7 out of 12 girls said that they were still not good with technology. However, 2 of the 7 girls thought that they were better because they had been building more projects but they still thought that they were not good with technology. For example, Betty said that unlike last year where she was just watching her dad building, he now let her do more hands-on building as she got older. “[My dad] is like teaching me more about [technology] so like I’m learning more from my dad.”

In post interview the girls’ perceptions of what counts as technology shifted somewhat to include programming (5 girls), robots (2 girls), switches (2 girls), fixing and putting things together (2 girls) and sewing machines (1 girl), in addition to including the usual devices such as computers, phones, iPads, and iPods (5 girls)

Confidence and experience in craft

We asked the girls about their confidence in craft and whether they enjoy making craft or not. In both the pre and post interviews, all of the 12 girls said that they enjoyed making crafts. Out of 12 girls, 11 indicated they often shared their craft projects with family members and friends—six of these doing so unprompted. Erica talked about her plan to make a handmade present for her cousin in exchange of the gift he gave her, “recently, my cousin made me a little bicycle for one of my dolls, and so I'm thinking I'm going to make him something.” Moreover, craft was perceived as a family activity for 6 of the girls. For instance, LillyJane talked about gathering random things at her room and make something out of them with her sister and baby sitter. She often made craft when her friends came over to her house. Lightbulb also said that her mom liked to do crafts and together they made small furniture and food out of clay for her dolls. In her free time, Lightbulb also enjoyed watching DIY videos on YouTube with her mom and sometimes by herself.

Additionally, the girls used craft to experiment and express. Kate talked about her experience experimenting with homemade slime putty or Play Doh. Describing her experiment, she said, “Play Doh–you need like flour, salt and water. And then for slime you need like detergent. You can actually use shaving cream.” She also added that making things out of homemade Play Doh with her female friends was “exciting to me, making it and trying to like discover what could make it and what can’t make it. It’s fun to experiment.” Erica enjoyed making things from cardboard to illustrate the stories she wrote. She made a fairy house, trees, and castle as props to her story. Similarly, Betty made castles and characters that went with it, “I made little people with swords and spears and stuff.”

Conclusions and Implications

The participants of this study came from privileged backgrounds with an abundance of exposure to technology. Their parents and schools actively sought to provide them with powerful STEM opportunities and experiences. However, 8 out of 12 girls still did not consider themselves competent with technology. The girls’ self-report on their technology confidence during interviews aligns with the literature on stereotype threats suggesting that women can feel less confident and significantly underestimate their abilities in the field of math, science, and technology. Moreover, half of the girls interviewed mentioned male family members as technology experts and compared their own expertise to that of the male family members. For example, Panni denied her identity as

a builder by suggesting this designation belonged to her brother. Erica also instantly mentioned her uncle as a technology expert when asked about her own experience with technology. This reflects the literature on women feeling technologically inferior to their male counterparts (Hill, Corbett, & Rose, 2010; Hyde et. al, 1990). When we investigate more closely what the girls considered to be technology, we found that programming and mobile devices were mentioned the most. Those activities and tools represent a narrow definition of technology. Furthermore, men are more represented in the professions related to these artifacts and practices, with women holding only 25% of all computing occupations (NCWIT, 2015). Broadening what counts as technology could increase diversity in these fields (Buechley, 2016) as a male-centric articulation of technology likely discourage girls from joining (Buechley, 2013; Margolis and Fisher, 2003).

In contrast to technology, all of the girls expressed confidence and interest in craft and enjoyed making craft as a social activity. While male family members were often associated with the girls' experience with technology, female family members and friends were a big part of girls' experiences with crafts. For example, Lightbulb's mother taught her and her sister to make toy furniture and food out of clay. Margie spent every Tuesday drawing and painting with her female babysitter while LilyJane frequently made crafts when her female friends visited her house. Unlike the girls' experiences with technology, their experiences with craft falls under the category of the producer rather than the consumer. Girls seem to have a deeper, more meaningful experience producing crafts, compared to playing games and watching videos which was frequently mentioned when asked about their technology usage. The girls also used craft to express themselves, as seen when Erica and Betty created scenes and characters of their stories from cardboards. Taking active roles in making crafts could positively influence girls' confidence. Additionally, the social implication of making crafts and sharing them with others makes the experience meaningful and enjoyable.

In an effort to improve girls' confidence in technology, we suggest that future pedagogical methods should first focus on widening what counts as technology. Limiting the definition of technology to male-centric tools and activities may discourage girls from seeing themselves as competent. We should also engage girls more as a producer of technology, as the true mastery of technology involves being both a confident producer and consumer (Resnick, 2012). Lastly, incorporating social implications to the girls' technological experience makes learning more enjoyable and meaningful.

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