"I'm Not Just a Mom": Parents Developing Multiple Roles in Creative Computing

Ricarose Roque, Karina Lin, and Richard Liuzzi
ria@media.mit.edu, karinalin@gmail.com, richard.liuzzi@gmail.com
MIT Media Lab

Abstract: Creating, designing, and building with computing have gained recognition as important activities for children, but few actually engage in these creative opportunities. Social support from parents can be essential to engaging children, but for parents with limited backgrounds in computing, they are often unsure what roles they can play. For parents to develop supportive roles, they must gain first-hand experience in creative computing for themselves and with their children. In this paper, we examine the experiences of parents participating in a community-based program called Family Creative Learning, where families design and invent together using creative technologies like Scratch. We describe three case studies of how parents developed multiple roles such as collaborator, teacher, and learner as they created and collaborated with their children on technology-based projects. We discuss design opportunities to provide meaningful experiences for parents and children to build projects and build supportive roles around computing.

Keywords: parents, families, roles, creative learning, computing, Scratch, MaKey MaKey

Introduction

While narratives of the "digital native" might suggest that young people are using computer programming and design-based computing activities on their own, many studies find a different story. In a study of youth who engaged in creative activities with computing, Barron and colleagues (2009) identified the many roles that parents play to support their children. Parents enact roles like collaborator, teacher, and learner to encourage, sustain, and deepen their children's learning experiences with computing. Although these roles do not require parents to possess domain knowledge, all of the families that Barron and colleagues (2009) studied had at least one parent with a technology-related background.

Parents without backgrounds and insights into the changing landscape of technology struggle to negotiate what roles they can play, such as how to work together in computing activities or how to find learning opportunities for their children (DiSalvo, Ried, & Roshan, 2014; Roque, 2013). At the same time, traditional roles are becoming complicated. Children develop roles as "technology brokers" with expertise beyond their parents (Correa et al., 2013). As a result, parents and other adult caretakers may assume more distant roles where their children will "just pick things up." However, parent co-activity and discussions can nurture their children's learning with technology (Simpkins, Davis-Kean, & Eccles, 2005). To support families to negotiate these emerging challenges with technology, studies suggest designing learning experiences where families can engage in joint activities around computing and parents can develop their expertise (Livingstone, Mascheroni, Drier, Chaudron & Lagae, 2015; Takeuchi, & Stevens, 2011). While there are many opportunities to broaden participation in computing, many initiatives engage young people or adults exclusively and often focus on individual skill development.

To examine how we can support parents who have limited expertise with technology to develop more active roles, we present a study of parents' experiences participating in a community-based program called Family Creative Learning (FCL) (Roque, 2016). Through FCL, parents and children learn to use new technologies and design projects together based on their interests. The program targets families with limited access to resources and social support around computing. Parents gain hands-on experience designing their own projects with creative technologies, while experimenting with roles that they can enact to support their children in this context. We argue that examining this process is a crucial first step towards understanding what supports and environments parents need to construct roles that align with their families' needs and backgrounds.

We ask (1) what kinds of roles did parents enact as they designed projects and worked with their children and (2) how did this creative computing experience support parents' development of these roles? We focus our study on three parents, each with children who are excited about the possibilities with computing. These parents ranged in technical expertise and came into the experience with varied goals, interests, and histories. We describe how families collaborated on projects and how different parental roles developed. Finally, we reflect on the

opportunities to further design experiences for parents and children to develop as learning partners with computing.

Background

In recent years, there has been a growing recognition of the importance for children to create, express, and build with technology. They can develop as computational thinkers as they engage with concepts, practices, and perspectives supported by computing (Brennan & Resnick, 2013; Wing, 2006). However, studies highlight a troubling participation gap in who engages in these creative activities, particularly among young women and ethnic minorities (Livingstone & Helsper, 2010; Margolis & Fisher, 2003). To understand how we can support broader participation in creative activities with computing, many argue that we need to move beyond thinking about access to technology and consider the broader ecology of social support and opportunities that surround a young person (Ito et al., 2013; Barron 2004).

Brigid Barron and colleagues (2009) took an important step to identify the kinds of roles that parents can play to support their children in the development of technological fluency. They identified seven roles: teacher, collaborator, resource provider, learning broker, non-technical consultant, employer, and learner. These roles demonstrate the ways that parents support children such as sharing expertise, finding opportunities, and providing encouragement. However, there are limitations to the general applicability of these roles. At least one parent in each household had a technology-related background with an appreciation and vision for the role of technology in their children's lives.

While Barron and colleagues identified roles, we also need to understand parents' motivations and values that underlie these roles. Clark (2012) identified two guiding principles that influenced parents' and children's uses of technology: an "ethic of expressive empowerment," or uses of technology for educational and enrichment purposes, primarily among middle to upper income families; and an "ethic of respectful connectedness," or uses of technology to maintain family connections, primarily among lower-income families. Research strongly emphasizes the influence of parents' support in children's learning experiences and pathways with technology (Simpkins, Davis-Kean, & Eccles, 2005). However, what supports are available for parents who have diverse motivations and backgrounds to develop positive and constructive roles? Parents also need learning opportunities and first-hand experience to understand the kinds of roles they can play.

While there have been a number of successful programs for families from under-represented groups in informal STEM learning activities (Weisbaum, 1990; Heil et al., 2012; Rivas & Olmsted, 2013), these initiatives have generally not focused on computational activities. Other programs have engaged parents and children in computer-based learning experiences, such as Tech Goes Home (http://techgoeshome.org) and Computers for Youth (http://cfy.org), but these initiatives have typically focused only on basic computer literacy for parents, such as looking up information online and using office applications. While these are important first steps in computational fluency, these efforts still fall short in providing opportunities that go beyond using and interacting and into creative and expressive uses of computing.

Design of Family Creative Learning

Family Creative Learning (FCL) is a community-based program that invites families to design and invent together using creative technologies (Roque, 2016). FCL has five workshops and are held in a community center once a week for two hours each. FCL is collaboratively implemented with staff from community centers, such as Boys and Girls Clubs and centers at housing developments.

The design of FCL draws on constructionist traditions of learning, which argue that people learn best when they are building things that are personally and socially meaningful (Papert, 1980; Kafai, 2006). Constructionism builds upon constructivist traditions that knowledge is not something that is transmitted or acquired, but something that is actively constructed through experience (Piaget, 1976). As people build projects, they build ideas. To be personally meaningful, the design of FCL invites families to build on their diverse "repertoires of practices" and "funds of knowledge" (Gutiérrez & Rogoff, 2003; Moll, Amanti, Nef & Gonzalez, 1992). To be socially meaningful, the design of FCL has also leveraged learning theories that emphasize the social aspects of learning (Brown, Duguid, & Collins, 1989; Lave & Wenger, 1991). Families are encouraged to work together as well as interact with other families participating in FCL.

The design of FCL goes beyond instructionist learning environments where there is a central instructor and pre-determined activities. FCL has four aspects that define its structure: tools, activities, facilitation, and environment. *Tools* include the Scratch programming language (Resnick et al., 2009) and the MaKey MaKey physical invention kit (Silver, Rosenbaum, & Shaw, 2012). *Activities* structure how families learn, interact, and collaborate on projects. *Facilitation* consists of research and community center staff and volunteers who provide

families with social support and encouragement. *Environment* includes both the physical arrangements and the socio-emotional space, which define how easily participants can interact and feel safe to take creative risks.

The five workshops are organized as follows: In workshops 1 and 2, parents and children independently learn how to use Scratch and MaKey Makey. Scratch enables families to create a broad range of interactive media such as games, animations, and stories, while MaKey MaKey enables people to simulate a keyboard using everyday materials such as aluminum foil and Play-Doh. In workshops 3 and 4, they collaborate on a family project. This arrangement allows parents and children to focus on being creators first before they engage with each other as collaborators. In workshop 5, they share this family project in a community showcase.

Each workshop is divided into four parts: Eat, Meet, Make, and Share. In *Eat*, workshops begin with a meal from a local restaurant, allowing all participating families and facilitators to eat with each other. In *Meet*, families split up into two groups and facilitators meet separately with parents and children to talk about their experiences in the workshops. In *Make*, parents and children engage in design activities with Scratch and MaKey MaKey. In *Share*, families talk about their projects to other families and receive feedback and questions.

In FCL, family members have the opportunities to take on roles that Barron and colleagues (2009) described, such as teacher, learner, collaborator, or non-technical consultants, as they participate in workshops that enable and support them to work on their own projects as well as a family project. The next sections describe how we studied families' experiences and the ways that these roles emerged.

Studying families' experiences

Settings and participants

We implemented the workshops in a Computer Clubhouse located within a Boys and Girls Club in an urban community in the northeastern United States. Computer Clubhouses are informal learning centers designed for low-income youth to engage in creative activities with technology (Kafai, Peppler, & Chapman, 2009). We recruited children between the ages of 7 and 12, but welcomed their younger and older siblings to participate.

We observed families in two program implementations in Spring and Fall 2013. In Spring 2013, five families participated for a total of fifteen unique participants with five parents (four mothers, one father; ages thirty-one to fifty-eight) and ten children (four girls, six boys; ages four to thirteen). Two of the parents were single mothers. Three of the families self-reported as Hispanic/Latino and these parents were immigrants. The other two families self-reported as White. All five families continued participating through the community showcase. In Fall 2013, six families initially participated, but two dropped out because of a family emergency and conflicting commitments. Among the remaining four families, there were nine unique participants with four parents (two fathers, one mother, and one grandfather; ages thirty-seven to fifty-nine) and five children (one girl, four boys, ages seven to eleven). One of the families self-reported as Hispanic/Latino, one self-reported as Black/African-American, and two families self-reported as White.

Data collection and analysis

To understand families' experiences, we primarily used ethnographic methods and collected multiple forms of data to triangulate our observations, in the form of field notes, individual and group interviews, and video recordings. During the Meet sessions, we asked parents and children questions such as, "What was it like to see your parent/child create a project with Scratch and MaKey MaKey?" and "What was challenging in working together?" Facilitators, which included the authors, wrote field notes. The Meet sessions and interviews were recorded and transcribed. To better understand participants' experiences during and after the workshop series, we conducted interviews with parents and children within one month after the series ended. We asked questions such as "How did you help your family member?" and "Why did you continue participating?" Qualitative data consisted of approximately 8 hours of video recordings, 70 observed hours total from 6 facilitator-researchers, 20 group interviews during the Meet sessions, and 14 individual follow-up interviews from 60-90 minutes.

We analyzed our data using grounded theory strategies (Charmaz, 2006) to uncover processes that contribute to parents development of roles by examining what parents did, how they interacted with their children, and what they said about their experience. We used the roles identified by Barron and colleagues (2009) in our coding and used the grounded approach to discover any other roles. All three authors participated in data collection, transcription, coding, and analysis. Through a six month period, we met weekly to discuss our data analysis and cases. These discussions served as our inter-coder reliability checks, making sure that each analysis was approved by all team members.

Of the original nine families, we focused on three families. These families were selected using the following criteria: (1) completion of a project for the community showcase and (2) availability of all participating family members for interviews after the workshop series. The three families show the different ways that parents

experienced this program with their children, but they are by no means representative of all parents' and families' experiences in the workshops.

Results

Our coding and analysis led to the identification of how parents developed different roles to support their children. We focused on the kinds of practices that parents enacted (e.g. brainstorming and asking questions), perspectives that parents said about themselves and their children (e.g. feeling uncertain about their skills, seeing how creative they can be), and interactions that emerged from parent-child dynamics as they participated in FCL (e.g. responding to children's struggles, building on their children's interests). The experiences of these three families highlight broader trends in other parents' development of roles, particularly the ways that parents built on their existing practices, connected to new perspectives about themselves, their children, and technology, and developed their interactions with their children in creative and positive ways around computing.

Sandy and Pete: Leveraging each other's interests and strengths

Sandy, a 41-year-old hair stylist, was excited to work on a project with her 10-year-old son, Pete. Pete had been learning to use Scratch before the workshops in the Computer Clubhouse, but MaKey MaKey was new to him. Sandy felt anxious after she made her Scratch project in workshop 1, as she considered herself a newcomer to technology. She looked forward to working with Pete and felt less overwhelmed knowing that he could help her.

During the child Meet session in workshop 4, Pete shared how tech savvy he was compared to his mother and how excited he was to serve as her "Scratch parent." In the parent Meet session, Sandy also shared how they often worked together for Pete's school projects, although she had never collaborated with him on a technology-based project. Sandy looked to Pete as her technical consultant and shied away from learning anything related to technology on her own. As they started their project and brainstormed ideas, Sandy was inspired by both the craft materials in the room and Pete's upcoming violin performance, and suggested they make a violin for the family project. Pete liked the suggestion and they continued to exchange ideas as they designed elements of a violin with MaKey MaKey and Scratch.

Sandy delegated tasks between them based on their interests and strengths, and told Pete, "I'll make it [the violin], you make sure it works." Pete used his abilities in computing to set up the Scratch code, and Sandy used her abilities in drawing to make the violin out of materials they found. Despite having delineated tasks, Pete and Sandy checked in with each other consistently throughout their process. As Sandy drew a violin on cardboard, she asked Pete to cut it out. As Pete looked through sounds on Scratch, he made sure to get feedback from Sandy for every sound he programmed. Throughout the workshop, Sandy asked Pete to let her try to troubleshoot when Pete struggled with the MaKey MaKey. Although Pete was unwilling at first, Pete and Sandy eventually shared the duty of attaching wires to the MaKey MaKey. In a post-workshop interview, Sandy indicated, "I felt more comfortable [using the MaKey MaKey] 'cause I could kind of bring my skills to it."

Between the workshops, Sandy and Pete discussed the project at home and how they could make it better. They brought Pete's violin to the workshop and used Scratch to record him playing violin. A facilitator suggested to Pete to include an image of his mother somewhere in the Scratch project just like he included a picture of himself. Sandy was initially excited about this idea, but when she noticed Pete's hesitation, she instead declared that they were satisfied with the project and called it "done."

When they shared their project at the community showcase, Pete actively included his mother when describing their design process. Both Sandy and Pete were proud and excited, and were eager to continue to use MaKey MaKey and Scratch. After the workshop, Sandy shared how pleased she was that her son was able to see her as "not just a mom" and that she finally "got to see what [Pete] was actually learning...and he wasn't just sitting there and playing games."

Case analysis

Sandy initially expected to be hands-off during the Make sessions because she never saw herself playing a significant role in technology-related projects. Pete echoed these thoughts when he expressed his intentions to assume a "Scratch parent" role to his mother. Before coming to the workshops, Sandy and Pete often collaborated on Pete's school projects. Within FCL, Sandy continued to practice the same roles, collaborator and non-technical consultant, that she typically used with Pete in other activities (Barron et al., 2009). Sandy remained flexible and made sure to balance the roles she enacted between her child's interests and her own capacities (Drummond & Stipek, 2004). Sandy moderated her collaborator role as she weighed her growing excitement in the creative process and Pete's interests, which she prioritized over her own. In leveraging each other's strengths, Sandy often deferred more technical tasks to Pete, limiting her opportunities to continue developing her own expertise with the technologies. By finding multiple meaningful entryways for involvement with Pete in a technology-related

project, Sandy took a significant step towards active involvement where she values the activities Pete engages in and encourages his continued participation (Peterson, 2013).

The craft materials with the MaKey MaKey were important FCL tools that connected Sandy's creative side, a side of herself she places values in and finds meaningful. The ability to be creative with the tools alleviated Sandy's anxiety regarding technology and brought her towards a wider perspective of the roles she could play with Pete and technology.

Rosa, Sonia, and Clara: Stepping back and stepping in

Rosa, a 49-year-old physical therapist assistant and mother of two daughters—Clara, 13-years-old, and Sonia, 9-years-old—looked forward to learning more about computers in the workshops and spending time with her daughters. However, she knew that unlike her daughters, who seem to pick up computer-related things very quickly, it would take her some time to do so.

During workshop 3, to create their community showcase projects, Rosa worked with Clara, while Sonia worked on her own on a table next to her family. Facilitators suggested this grouping after sensing Sonia's independent personality. Like Sandy and Pete, Rosa and Clara were aware of each other's abilities and interests and collaborated on two musical instruments: a cardboard guitar and foil drum set. Rosa got the physical materials ready, while Clara programmed Scratch. Together, they connected the instruments to MaKey MaKey.

Meanwhile, Sonia was working next to them with the help of a facilitator Alex. While her mother and older sister were already assembling their two instruments, Sonia was still trying to get her MaKey MaKey project to work with pieces of Play-Doh. Alex helped her through her various issues such as connecting MaKey MaKey to her computer. Once she got some musical notes on Scratch to play with the Play-Doh through the MaKey MaKey, Sonia decided to make a drum with foil plates and took apart her working project. At this point, Alex left to check-in on other families while Rosa checked-in with Sonia. Rosa expressed enthusiasm for Sonia's drum project and helped her in disconnecting MaKey MaKey from the Play-Doh. When they shared projects at the end of the workshop, Clara and Rosa shared their nearly finished project, while Sonia had difficulty getting hers to work, insisting that it worked before. She felt discouraged when she was unable to fix it. Rosa gave Sonia a hug, reassuring her that she did a great job and that her project just needed to be fixed.

In the parent Meet session during workshop 4, Rosa expressed how much she enjoyed working with MaKey MaKey, but wondered if she was being helpful to her daughters who seemed to know more than her. A facilitator heard these concerns and assured Rosa that her practices in providing feedback and encouragement for her children were helping Clara and Sonia work through their projects. The facilitator then asked Rosa how she felt about Sonia working on her own. Rosa felt that because of Sonia's independent spirit, it made sense for her to work on her own project, but she planned to pay more attention to her in this workshop.

In the Make session, Rosa made sure to situate herself between her two girls so she could also check on Sonia. While Rosa tried to be more involved in Sonia's project, Sonia already had a clear vision and wanted more control over the process, trying to program the project and build the MaKey MaKey connections herself. Rosa decided to step back and watched Sonia, providing support when Sonia asked her for help. However, as Sonia continued to struggle, Rosa became more involved, helping to figure out issues with facilitators and making suggestions when Sonia seemed unsure. For example, knowing Sonia's sense of style, Rosa suggested decorating the cardboard with pink leopard print duct tape, which Sonia happily incorporated. As Sonia finished her project, Rosa made sure to give her positive comments on what she had accomplished.

Case analysis

Rosa's responsiveness to her two children reflected the kinds of roles that she took on to support them. With Clara, she seamlessly became a collaborator and engaged in different design practices such as building on each other's interests, splitting up tasks, and working together to integrate the different parts of the project. With Sonia, Rosa had to adapt her roles based on Sonia's needs. Sonia wanted to work independently and Rosa initially stepped back becoming more of a non-technical consultant as she encouraged her and gave her reassurance, especially since a facilitator was helping Sonia. However, after noticing Sonia's struggles to work independently, Rosa responded to her daughter, stepping in and out more to scaffold the creative process for her like a facilitator. Although Brigid Barron and colleagues (2009) described the teacher role as someone who could pass expertise to their child, Rosa scaffolded her daughter's design experience based on what she felt her daughter needed, despite still developing her own expertise. Rosa's case represents the fluidity of parent roles and how they respond to the situation and what they believe their children need.

Meanwhile, facilitators were also observing Rosa supporting her children. In workshop 1, Rosa initially expressed uncertainty in her ability to support her children. While Rosa displayed both design practices and supportive practices during the workshops, she still admitted feeling like she was not contributing. Facilitator

feedback and joint reflection with other parents helped Rosa make connections from her experience to the roles she can play with her children.

Tim and Ethan: From regulating to facilitating

When Tim, a 38-year-old father of three, first came to the FCL workshops with his 11-year-old son Ethan, he was unsure what the program was even about. While Tim used computers for his mapping work for the city, he was insecure about his abilities to learn how to code. He was also wary of Ethan's growing interest in computers, and monitored the amount of time Ethan and the rest of his children could use the computer, even referring to his role as "the guardian, to kind of regulate." Despite these reservations, Tim wanted to better understand Ethan's interests. He understood his other children's interests in dance and hockey, but was unsure of what Ethan was "into." Ethan, on the other hand, was very excited to attend the workshops. He was already learning how to use Scratch at the Computer Clubhouse and wanted to learn more.

During the Make session in workshop 1, Tim did not ask many questions, but instead followed directions in an activity guide provided to him by facilitators. He soon explored the blocks on his own. By the end of the evening, Tim created a project that animated his initials and played a recording of his voice saying hello to his children. After the workshop, Tim pursued his growing curiosity with Scratch and created a Scratch account for himself. During workshop 2 Make session, he explored more advanced features such as cloning. During the Share session, a facilitator asked him to explain what he did in his project. Tim claimed to not know, but a facilitator encouraged him to try and he described his process successfully.

While Ethan created more advanced Scratch projects than Tim, Ethan started to feel eclipsed by his father's growing proficiency and enthusiasm. However, when it came time for them to work together on a project in workshop 3, Ethan was excited when facilitators asked the children to use their expertise with Scratch to support their parents. He was looking forward to sharing what he can do with Scratch with his father, and he hoped to learn something from his father as well.

When it came time for father and son to work together, Tim's growing confidence with Scratch and Ethan's eagerness to be a Scratch mentor to his father did not materialize in the type of project collaboration that facilitators had expected. Over the course of the Make session, Ethan primarily took charge of the project, while Tim assisted and observed. As Ethan became familiar with MaKey MaKey, Tim took items from the materials table and presented them to Ethan to experiment with. He would occasionally give Ethan suggestions on how to connect them, reminding Ethan what he needed to do to make his project work. As Ethan took greater ownership of the project, Tim became less involved and observed more as Ethan made a "banana mouse" that used the mouse movement inputs on MaKey MaKey. During Share, Ethan talked about his design process and project without mentioning his father, who watched as he presented the project.

Case Analysis

While Tim's limited involvement in their shared project could be explained as disengagement, Tim was an active facilitator rather than a passive observer. He consciously chose to let his son take the lead, while he supported him—reversing typical parent and child roles, with the son as the leader and the father as the assistant. Tim observed what Ethan was doing, provided assistance in learning how to use MaKey MaKey without giving direct answers, and encouraged Ethan to experiment with materials and design their project. Tim wanted to support his son's passion for technology and skill with Scratch by allowing Ethan to take charge. As Ethan took more ownership, Tim gradually became less involved, but remained observant, ready to step in if needed. In a post-workshop interview, Tim said:

> He [Ethan] knows what he wants to do and he'll let me know if I can help. For the most part, he's going to run the show and that's fine with me...I'm pretty secure with myself. I think it empowers them... I think they're proud to be able to say "Oh, listen, I know how to do this. Let me show you."

Through his desire to uncover what his son was "into" and how his son defined himself, Tim immersed himself in learning Scratch and MaKey MaKey in the first two workshops when he was working on his own. In doing so, Tim had the opportunity to consider the parental role he played as a gatekeeper regarding Ethan's use of technology. For some parents, anxieties around technology use can sometimes lead to decisions that can limit computing opportunities for their children (Tripp, 2011). By experiencing creating with Scratch and MaKey MaKey himself and watching his son enthusiastically build a project, Tim came to better appreciate what his son is "into" and how his son identified with this interest. This shift in perspective creates potential for Tim to assume a learning broker role that finds opportunities for his children.

Discussion: Enabling and supporting parents as learning partners

A goal of Family Creative Learning was to create an environment where parents can both engage with their children in design-based computing activities as well as explore roles to support their children in an unfamiliar but increasingly important context within our digital society. We wanted parents to not only walk away with content and skills, but also to experiment with roles to support their children around computing.

The case studies demonstrate the ways that parents' participation in these design-based activities with their children enabled and supported the roles that they played in this program. At the beginning of the workshops, parents expressed concerns about what their children do with technology and anxieties around supporting their children with computing activities. Some parents called themselves "computer illiterate," while others saw themselves as regulators of their children's computer use. However, over the course of the workshops, the parents in these case studies demonstrated their commitment to supporting their children through a variety of practices and roles. Sandy and Pete leveraged each other's strengths, ideas, and interests. Rosa tried to step in and out throughout Sonia's successes and struggles with her project. Tim relinquished creative control to Ethan, but watched him closely, made suggestions, and gave encouragement along the way. These differences demonstrate the importance in designing environments that invite parents to explore and discover roles that build upon their strengths, children's needs, and family's goals — rather than prescribing defined and constrained roles without changing trajectories of participation.

There were also tensions present with parents and children working together on projects within a context the children often felt a strong ownership over. While they liked seeing their children take charge and display their growing expertise, parents sometimes had challenges integrating their own interests into their shared experiences. For example, even though Sandy and Pete had a generally productive collaboration, Sandy often had to ask Pete to give her a chance at working with MaKey MaKey, too. We found that every family experienced these kinds of tensions, but these tensions were part of the family's continual negotiation of roles around computing. More importantly, these negotiations enabled parents to explore and experiment with practices and see for themselves what worked and what did not to support their children. Facilitators and designers of these environments should pay attention to when these negotiations and tensions lead to disempowerment or marginalized participation. While not documented in these case study families, there were some families that could not work well together in the workshops. Facilitators often intervened to help them think aloud their ideas together or to suggest that they work on separate but nearby computers.

Additionally, children experienced first-hand the benefits of working with their parents on design-based projects. Because of children's greater familiarity with and excitement around computing, the typical teaching roles between parents and children were reversed, with children often leading the creative process and explaining the technologies to their parents. This reversal allowed children to try out new roles, such as a teacher of technology to their family members, in addition to being a creator. Their parents also reinforced these new roles and practices by asking their children to help them or take the creative leadership.

We are also interested in how to design environments that can support families to develop as creative learning partners around computing. It is not enough to merely enable parents and children to create together. *How* we design the learning experience matters. The tools, activities, facilitation, and environment should be designed both for expressive empowerment and respectful connectedness (Clark, 2013) and to support the multiplicity of motivations, goals, and priorities of families. In these case studies, we found that these features of FCL contributed to parents' engagement as learning partners: the flexibility and ease of use of the tools allowed families to create different kinds of projects that connected to the different kinds of interests in the room. The use of crafts and everyday materials also became a bridge for parents from one familiar medium into a new one. The activities fostered interactions within and across families through shared meals, meetings with their peer groups, collaborative interactions, and opportunities to talk about and share their work. Facilitation positioned the participants as creators and collaborators in addition to supporting the development of their expertise. The environment created a physical space where they could work together. It also created a socio-emotional space where they could feel respected and safe within a technology-based context where they were often unsure about their capacities and the roles they could enact for their children. These features are not independent, but interact throughout the workshops to support parents in negotiating roles and practices.

By engaging parents in a creative learning environment with their children, parents and children had opportunities to see both themselves and each other take on more empowered roles as learning partners. Parents could see the positive and creative things that their children could do with computers—an object that was often a source of contention between family members. Children could see their parents as creative designers with computers and experience working on projects together as a family—activities which often fell in the domain of games, crafts, and homework. Computing outreach programs often serve children, without integrating other people in the larger learning ecology (Barron, 2004). Children are left to explain and advocate for their interests

to their peers, parents, and teachers (DiSalvo et al., 2013). Through a shared experience of designing and creating their own projects, families could apply practices that they used in other activities, such as homework help, and adapt it to the context of computing. Families can build connections to this important context in their lives while building relationships within their families and connecting to other families in their community. By engaging in design-based computing activities at their own community center, parents come to understand the wider learning ecology around their children's developing interests and see the kinds of people, activities, and interactions that can support their children—and develop a variety of ways to participate in these worlds as well.

References

Barron, B. (2004). Learning ecologies for technological fluency: Gender and experience differences. *Journal of Educational Computing Research*, 31(1), 1–36.

Barron, B., Martin, C. K., Takeuchi, L., & Fithian, R. (2009). Parents as learning partners in the development of technological fluency. *International Journal of Learning and Media*, 1(2), 55–77.

Barton, A. C., Drake, C., Perez, J. G., Louis, K. S., & George, M. (2004). Ecologies of parental engagement in urban education. *Educational Researcher*, *33*(4), 3-12.

Brennan, K., & Resnick, M. (2012). New frameworks for studying and assessing the development of computational thinking. *Presented at the American Education Researchers Association*, Canada.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.

Clark, L.S. (2013) *The parent app*. Oxford, United Kingdom: Oxford University Press.

Correa, T., Straubhaar, J.D., Chen, W. & Spence, J. (2013) Brokering new technologies: The role of children in their parents' usage of the internet. *New Media and Society*, 0(0), 1-18.

DiSalvo, B., Guzdial, M., Bruckman, A., & McKlin, T. (2014). Saving face while geeking out: Video game testing as a justification for learning computer science. *Journal of the Learning Sciences*.

DiSalvo, B., Reid, C., & Roshan, P. K. (2014). They can't find us: the search for informal CS education. *In Proceedings of the 45th ACM SIGCSE* (pp. 487-492). ACM.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher*, 32(5), 19–25.

Ito, M., Baumer, S., Bittanti, M., Boyd, D., Cody, R., Herr-Stephenson, B., Horst, H. A., et al. (2009). *Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning with New Media*. MIT Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Livingstone, S., & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New Media & Society*, 12(2), 309–329.

Livingstone, S., Mascheroni, G., Drier, M., Chaudron, S., & Lagae, K. (2015) How parents of young children manage digital devices at home: The role of income, education and parental style. Retrieved from: http://eprints.lse.ac.uk/63378/

Margolis, J., & Fisher, A. (2003). Unlocking the clubhouse: Women in computing. Cambridge, MA: MIT press.

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. Theory into Practice, 31(2), 132–141.

Papert, S. (1980). Mindstorms: children, computers, and powerful ideas. New York, NY, USA: Basic Books.

Peterson, T. K. (2013). *Expanding minds and opportunities: Leveraging the power of afterschool and summer learning for student success*. Washington, DC: Collaborative Communications Group.

Resnick, M., Maloney, J., Monroy-Hernandez, A, et al. (2009). Scratch: Programming for all. *CACM*, 52, 60-67.

Roque, R. (2013, July 15) Collateral benefits: Focus groups as social support groups. [Web blog]. Retrieved from: http://ethnographymatters.net/2013/07/15/collateral-benefits/

Roque, R. (2016, *Forthcoming*) Family Creative Learning. In Peppler, K., Kafai, Y., & Halverson, E. (Eds.) Makeology in K-12, Higher, and Informal Education. New York, NY: Routeledge.

Silver, J., Rosenbaum, E., & Shaw, D. (2012, February 19–22). Makey Makey: Improvising tangible and nature based user interfaces. *Proceedings of the International Conference on TEEI*. New York: ACM.

Simpkins, S. D., Davis-Kean, P. E., & Eccles, J. S. (2005). Parents' socializing behavior and children's participation in math, science, and computer out-of-school activities. *Applied Developmental Science*, *9*(1), 14-30.

Takeuchi, L & Reed, S. (2011) The new co-viewing: Designing for learning through joint media engagement. Retrieved from: http://www.joanganzcooneycenter.org/wp-content/uploads/2011/12/jgc_coviewing_desktop.pdf

Wing, J.M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33-35.