**Families Creating Together: Engaging Children and Parents in Design-Based Activities for the Cultivation of Computational Literacy**

In this Community Anchor Research Project, the Information Science department at University of Colorado Boulder (CU Boulder) proposes to design and study a family learning program that engages children and their parents in design-based activities for the cultivation of computational thinking. The proposed cost of the project is $369,463. The project will focus on high-need families and the family learning program will involve creative technology workshops for children (approx ages 4-7) and parents to create and learn together with computing. The CU Boulder team will support local libraries and volunteers in the Boulder and Denver area to facilitate these workshops and develop a facilitator guide to share the model with more libraries. This project will use design-based and ethnographic research approaches and use the Connected Learning framework to ask: *how can we engage children and their parents in design-based activities for the cultivation of computational literacy?*

**NATIONAL NEED**: In the past decade, leaders in education, research, industry, and policy have recognized computational thinking, or using the ideas and strategies from computer science to help people solve problems and understand our digitally connected world (Wing, 2006). For this proposal, we want to use the term *computational literacy*, to highlight how we want to support people to develop as computational creators — people who can read and write with computing. Learning to code, or creating and expressing oneself with computing, can be a means to develop computational literacy (Brennan & Resnick, 2012).

Social support can play a major role in engaging and deepening what young people can learn and do with technology. In particular, parents can be collaborators, resource provides, and co-learners (Barron et al., 2009). The American Academy of Pediatrics (2016) recently adjusted their recommendations to encourage parents to act as "media mentors" for their children. To support parents in this role, parents and families need access to opportunities that allow them understand the kinds of roles they can play and the practices they can take on to support one another. However, access to quality computing resources and opportunities remain a challenge for families, especially from low-income households (Rideout & Katz, 2016).

In a report from the American Library Association's Office of Technology Policy, Braun and Visser (2016) echo this national need to support young people to develop computational thinking and emphasize the important role of libraries as a site for this engagement, especially for engaging high-need populations. Libraries already play important roles in providing access to technology and family learning opportunities, but, as Braun and Visser (2016) highlights, libraries need more education and funding to provide computational thinking opportunities.

This proposed project builds on similar IMLS-funded projects to support family learning such as the STEMEx initiative. This project, however, focuses on computational literacy and aims to build libraries capacities to facilitate these opportunities within their community. Like STEMEx, we plan to leverage local volunteers with computing experience, but we plan to frame their role as co-learners with families rather than experts.

**PROJECT DESIGN**: The primary research question addressing these needs are: how can we engage young children and their parents in design-based activities for the cultivation of computational literacy? We will pursue the following sub-questions: (1) What challenges and barriers do parents and their children face in participating in technology-based learning opportunities in their libraries? (2) How can we design programs and structures within libraries that address those challenges and to support children and parents to build on their interests and backgrounds, or "funds of knowledge", to engage in computational literacy? (3) In participating in these programs, how do children and their families develop as computational creators and what aspects of these programs support children and families in their development?

PI Ricarose Roque has been conducting research engaging families in creative computing since 2012 through the Family Creative Learning (FCL) project, which engaged children (between 8 to 12 years old) and their parents from low-income communities in creative technology workshops (Roque, 2016). Roque also produced a Facilitator Guide (http://family.media.mit.edu/guide) for educators to adapt this model, which has been downloaded more than 2,000 times and featured by organizations such as MakerEd.

Building on the success of FCL, this proposed project will focus on families with younger children (approx. ages 5-7 years old). The family program will consist of a series of workshops and include developmentally-appropriate tools and activities for children and engage parents as active facilitators, collaborators, and co-learners with their children. The creative computing tools include the ScratchJr environment, a tablet-based programming language developed specifically for children ages 5 and up. The activities will focus on *story-making*, building on the important role that storytelling plays in supporting literacy and celebrating cultural histories of families. Based on

past FCL workshops and initial discussions with librarians, we plan to provide dinner for families at the start of the workshops to attract families and alleviate the load from already busy parents. During dinners, facilitators will engage families in activities that build relationships among participants. The program structure will build on past FCL model with an initial implementation plan that will consist of a series of five two-hour workshops, held in the week-night evenings. Between workshops, we will provide activities for families to continue story-making at home. We anticipate supporting about 20-25 people for each workshop. The project team has started discussions and implemented pilot workshops with local librarians in the greater Boulder and Denver area such as the Boulder Public Library and Anythink Library. We will work with other organizations such as schools and public housing developments to recruit families from high-need groups.

This project will leverage the Connected Learning framework, which provides a model to design and build environments that support youth from diverse interests and backgrounds, especially non-dominant youth, and connect these experiences to future opportunity. We will use design-based research and participatory approaches to develop the family learning program. This process is characterized by iterative cycles of "design, enactment, analysis, and redesign" (Design-Based Research Collective 2003, p. 5). Staff partners at local libraries in the greater Denver area will participate in this iterative process, which will also be informed by observations and feedback from families participating in the programs.

Research data collection will use ethnographic approaches to understand families' learning experience, with multiple forms of data to prevent bias. Observations, short interviews with children and parents, and pre- and post-surveys will provide immediate feedback to the project iterations. Our analysis will use a grounded theory approach to examine in-depth interviews, project artifacts, and field notes to develop case studies of family participation. We will use the computational thinking framework developed by Brennan and Resnick (2012) to assess families' development of computational literacy from our collected data. The project team will convene an advisory board, which will include William Penuel, Professor at the School of Education at CU Boulder who is currently engaged in an IMLS-supported project to develop evaluation tools to measure Connected Learning program outcomes within libraries; and Natalie Rusk, Director of Learning Research for the MIT Scratch Team, who leads an NSF-supported project creating interest-based pathways into computational literacy. We plan to invite two practitioners with expertise in designing computing programs in libraries and engaging families in computing.

**NATIONAL IMPACT**: This project will support a national need to provide computational thinking opportunities by engaging younger children and their families from low-income communities. This approach addresses IMLS priorities in early learning and STEM. Project outcomes are (1) a model of family engagement with young children in computational literacy; (2) support for librarians to facilitate this model into their settings; (3) evidence-based case studies of family participation and library facilitation. To develop the model (1), we will engage in a design-based research approach in partnership with librarians and in response to family feedback and experiences. To support libraries' facilitation (2), we will produce a facilitator guide and host recorded webinars and in-person professional development at conferences. Finally, to develop the evidence-based case studies (3), we will use ethnographic methods to develop rich-descriptions of families' experience and use the computational thinking framework proposed by Brennan and Resnick (2012) to assess their development of computational literacy. We will share these results at library and learning science conferences.

**SCHEDULE**: The research project follows a three-year timeline. In Year 1, we will conduct focus groups with parents to understand the challenges that families face in engaging with technology-based learning opportunities. These focus groups will inform the design of the workshops, which we will begin piloting in the second half of Year 1. In Year 2, we will conduct 10 workshops, or two program iterations, with libraries in the greater Boulder and Denver area, where we will conduct our research data collection. In Year 3, we will analyze data to inform the development of a facilitation guide for other librarians to adapt this model into their settings. In addition to this guide, we will support online webinars and in-person professional development at conferences like ALA.

**BUDGET**: The total cost for this project is $369,463. Salaries and wages will be $187,867, which will support 1 summer month of PI Roque's time for three years and a graduate research assistant for three years to participate in the design, implementation, research, and dissemination of the project. Conference travel support for PI Roque and the graduate student in Year 2 and 3 will be $10,143. Participant support will cost $2,000 to support librarians and volunteers who will help to adapt, run, and facilitate the family workshops in Year 1 and 2. Direct costs which will support materials and food for the workshops ($7000), support four advisory board members to visit during Year 1 and Year 3 ($8000), and tuition remission for a graduate student across three years ($39,428) will all together cost $54,428. There will be no cost sharing or contracts and sub-awards. The indirect cost will be $115,025.