

## Capturing Computational Thinking Literacy Development in Public Libraries

This *Research in Service to Practice* proposal is led by the University of Maryland, in partnership with American Library Association's Washington Office (ALA WO) and the Young Adult Library Services Association (YALSA) who are currently leading the national initiative, [Libraries Ready to Code](#) (RtC). Drawing on research from the learning sciences and computing education communities on types and models of assessments of youth's computational thinking (CT) skills (Grover & Pea, 2013; Tissenbaum et. al, 2018; Weintrop et al., 2014), our research questions for this three-year grant proposal are: (1) What computational thinking skills and practices (CT literacy) can youth (ages 13-18) develop through public libraries? (2) What assessment tools and practices can best capture CT literacy among youth in libraries? (3) How can these assessment tools and practices inform the development and improvement of CT youth programs offered through public libraries? The major practice outcome of this project will be a collection of assessment tools and a suite of case studies demonstrating CT literacy development among youth aligned with desired CT learning outcomes that are tailored to the needs and capabilities of public libraries. This project is in complete alignment with the [IMLS Strategic Plan](#), primarily goal 1, "Promote Lifelong Learning", with a special focus in fulfilling objectives 1 and 2 within this goal (IMLS, 2018, p. 4-5). The proposed cost of the project is \$398,648.

### *Statement of National Need*

Braun & Visser (2017) conducted a nationwide scan of libraries offering CT or computer science (CS) programs for youth and found that libraries are abundantly offering such programs. During the recent call for proposals for the RtC grant program funded by Google to support CT/CS programs for/with youth, especially underrepresented youth, ALA WO received over 400 applications, but only [30 libraries](#) were selected to participate. It was discouraging to see that almost 90% of the applicants stated that attendance and retention will serve as the primary means of measuring outcomes of their CT program. Only 10% of the grant recipients considered themselves expert in the area of youth CT learning assessments, and this percentage did not increase by the end of the grant program. Only 39% of grant recipients reported that they had addressed the RtC theme of showing impact through outcomes in their programs. Of the 70 material resources developed and shared by grant recipients, only 9% of these materials included some form of assessment of CT. The recipients of the RtC grants overwhelmingly reported they were unable to demonstrate the impact of their programs because they did not know what CT literacy development looked like or how to measure it.

This project fulfills four immediate needs. **Need 1:** A clear understanding of what CT is and how to assess it in library settings. **Need 2:** Creating effective CT assessment tools that fit within the dynamic and diverse constraints of libraries (such as one-off CT programs ranging from a few hours to weeks). **Need 3:** Develop strategies for libraries to demonstrate and communicate their vital impact in measurable learning metrics to sustain CT/CS programming, recruit mentors and community support, and attract external funding. **Need 4:** Relatively little is known about how to measure and evaluate CT learning experiences in out-of-school environments. This project will contribute to research by advancing our understanding of how to identify and measure CT learning beyond the classroom. Collectively this proposal has the potential to impact libraries, library staff, and youth programming across the country, helping achieve the goal of bringing CT to all learners.

### *Project Design*

The project lead will be Dr. Mega Subramaniam (an expert in creating learning environments in libraries that foster the development of emerging digital literacies and serves as the RtC initiative Fellow) and Dr. David Weintrop (an expert on designing and evaluating CT learning opportunities). We have pre-commitments from both partners – ALA WO and YALSA – whose roles are described in the *Project Design* section below. An advisory board (AB) consisting of representatives from project partners (Marijke Visser, Associate Director of Public Policy who leads the RtC portfolio of activities for ALA and Linda Braun, the Continuing Education Consultant for YALSA), the current external evaluator for RtC (Caitlin Martin from CKMartin Consulting), leading CT assessment experts (Victor Lee from Utah State University and Aman Yadav from Michigan State

University), and an expert on overall public library assessment (John Bertot from the University of Maryland) will assist project PIs. We have pre-commitments from all AB members.

Year 1 - The first year of the project will be devoted to understanding the current state of CT programming and assessment in libraries and conducting a systematic review of the landscape of CT assessment research (broadly defined). We will conduct virtual interviews with 50-60 public library staff serving teens nationwide and educators/staff from other informal learning environments and organizations (e.g., museums, community centers) who have offered CT/CS programs to investigate their understanding on what CT literacy is, how they measure CT/CS learning outcomes, what data they collect to evaluate their programs, and what tools they use to capture CT literacy. We will also conduct 2-3 focus groups at the YALSA Symposium 2019 and ALA Midwinter 2020 tackling similar questions, facilitated by our project partners. All data generated will be analyzed using established qualitative methods. Typologies of CT programs offered through libraries will be developed, along with a catalog of learning outcomes and data collection tools and strategies for evaluating CT programs. We will share the results of Year 1 via the [RtC website](#), YALSA and ALA communication channels, participants of the [YALSA's IMLS-funded Train the Trainer](#), and research articles and presentations.

Year 2 will be primarily dedicated to developing the bank of assessment tools to capture CT literacy development, with extensive input from librarians and teens. To leverage current work in CT and to build synergy with ongoing IMLS-funded projects, we will utilize participants of YALSA's [Train the Trainer](#) (state library agency staff and frontline public library staff from 50 states and 6 territories) and coaches that were previous RtC grantees to develop and refine these assessment tools at the YALSA Symposium in 2020. We will use participatory design techniques, a cooperative inquiry method, to develop prototypes of assessment tools (Druin, 1999, 2005). After further refinement of the assessments, we will contact a subset (5-8 libraries) of these participants to deploy these tools in their programming. We will then analyze the resulting datasets, and mentor them to communicate the impact of CT programs to their stakeholders. Using a multiple case-study approach, the data collection in Year 2 will be used to create in-depth case studies (which will include the outcomes measured, tools used, analysis, and impact) that will be shared widely.

Year 3 will be dedicated to further deployment and validation of these tools and materials nationwide. We will have an open call for any public libraries to use our tools (selecting about 15 public libraries offering CT programs for youth at rural, suburban, and urban areas), and conduct analyses of the data collected and communicate the impact, with mentorship from the project team. These librarians will be required to share their process through the use of the case-study format previously implemented in Year 2, which the project team will widely disseminate through our partners' communication networks, and research and practitioner venues.

### *Project Impact*

This project will support a national and immediate need to capture and quantify CT literacy development among youth who participate in CT programming through public libraries. Project outcomes include: (1) a list of learning outcomes that can be achieved through CT programs for youth in libraries; (2) a bank of assessment tools for capturing CT literacy development; and (3) case studies focusing on CT literacy development among youth in libraries. These deliverables can be used by librarians nationwide to design, develop, implement, and assess youth CT programs, and can be used to communicate impact of their programs to policymakers, funders, and other stakeholders. The project will also advance research in CT literacy through libraries, which is almost non-existent, and will contribute to the understanding of the importance why and how youth library programming contribute to CT literacy development.

### *Budget*

Funds are requested for: (1) salary and fringe benefits for the PIs during the summer (\$76,331); (2) support for a graduate student, including tuition, stipend, benefits, and fees (\$145,694); (3) travel support for PIs and full-time graduate student (\$13,500); (4) stipend for project partners, advisory board members, and librarian participants (\$38,500); and (5) data analysis supplies (\$2,000). In total, the cost will be \$398,648 for the project, inclusive of indirect cost of \$122,623. There will be no cost sharing or sub-awards.