Libraries Count: Co-Developing a Professional Learning Program to Build Capacity of Library Staff to Support Diverse Young Children and their Families in Math

Narrative

PROJECT JUSTIFICATION

Introduction. Early Childhood STEM Lab at East Tennessee State University (ETSU) will partner with the School of Library and Information Studies at the University of Alabama to lead the proposed LB21 project, *Libraries Count: Co-Developing a Professional Learning Program to Build Capacity of Library Staff to Support Diverse Young Children and their Families in Math*, a 3-year Applied Research project. Our project will (**goal 1**) co-develop the *Libraries Count* program with key stakeholders from a culturally-responsive, strengths-based perspective in diverse settings; (**goal 2**) pilot, evaluate, and iteratively improve the program in two states, TN and AL; (**goal 3**) roll out and evaluate the impacts of the program at scale through WebJunction across our two pilot and eight additional states (that include AZ, CA, CO, MA, ME, MD, NJ, NY), and; (**goal 4**) publish the final *Libraries Count* program on WebJunction for libraries to access for free nationally.

The mixed-methods research will evaluate the design process and impacts on early math knowledge and capacity building for library staff and families, with a budget of $467,587 Our project is appropriate for, Goal 1: "Recruit, train, develop, and retain a diverse workforce of library and archives professionals, and Objective 1.3: Develop training for library and archives workforces to support families, groups, and individuals of diverse cultural and socioeconomic backgrounds and needs including but not limited to young children and their caregivers…." Our project is appropriate for this Goal because it will co-create a training and professional development program for library and archives professionals who work in a variety of regions and who work with different stakeholders. The program will enhance their ability to support young children and their families from diverse backgrounds (e.g., rural communities; Latinx populations; low-resource, urban areas) in early math, offer opportunities to expand their programming and the reach of their programming to development areas that are less often incorporated in library programming. The project would run from Aug 1, 2022-July 31, 2025.

Research Questions (RQ). The following are the research questions addressed in *Libraries Count*:

RQ 1. To what extent does a collaborative, co-development process between diverse families, library staff, and content experts/researchers empower collaborators (families, library staff, researchers) and result in the creation of an adaptable, sustainable, and culturally-responsive professional learning program? (**goal 1**, objective 1)

RQ 2. How do diverse families and library staff view the *Libraries Count* program in terms of its applicability to their own lives, relevance to their context, and the extent to which it is culturally responsive? (**goal 1**, objective 2)

RQ 3. What impact does the *Libraries Count* program have in increasing library staff's knowledge about a) early math content, development, and learning, b) ways to engage diverse families in early math, and c) ways to include early math in library programming? (**goals 2-3**, objective 3-4)

RQ 4. What impact does the *Libraries Count* program have in influencing library staff members' attitudes, beliefs, and confidence in supporting early math in young children and in their work with diverse families? (**goals 2-3,** objective 5)

All the research questions and objectives (see below) are designed in a manner to help achieve **goal 4** in terms of an impactful, relevant, rigorously evaluated, and effective deliverable.

Problem Statement. Math skills and knowledge upon entry to kindergarten strongly predict young children's educational trajectories, even into high school [1]. The pandemic has disproportionately impacted math learning and children from diverse backgrounds [2, 3]. We can draw from the substantial knowledge about how early math develops

and how to support early math learning, in addition to the vast assets that diverse children, families, and libraries bring to the table, as we bring in and raise up the brilliance of young children in early math and the adults who support them. However, we must counter the misconception that math is learned in classrooms starting in school because we know that math learning develops all the time, everywhere, starting at birth, especially in the context of families. Barriers to providing sustained support for young children and their families in library settings include adult anxiety related to doing math with children, uncertainty about how to bring early math into library programming, and the limited content typically included in this area in programs to prepare library staff [4,5]. Professional learning (i.e., professional development) could address misconceptions and expand math in libraries, but such programs are rare [6,7,8].

Our project will address these challenges by creating and evaluating an online professional learning program, *Libraries Count*, for library staff (target group) to integrate math into programming for diverse young children (ages 3-5) and their families (beneficiaries). Ultimately, our goal is to support children and families living in diverse underserved communities who need support the most, like in the rural Appalachian region and in urban areas (e.g., with large % Latinx population).

Existing early library-based professional learning programs focus on early literacy (e.g., Supercharged Storytimes hosted by WebJunction), or school readiness broadly (e.g., Reimagining School Readiness), but none focus on math specifically with young children and their families. We have learned that online supports to build capacity with library staff can be effective when they are well-designed (e.g., leveraging expertise of WebJunction) and when they draw from research on principles of effective adult learning [9], and we know the value of a focus on early math for later learning [1]. We can support developmentally-appropriate math experiences with young children grounded in what is already around them and familiar (see Figure 1). What we do not yet have is a program with this particular early math focus that is co-designed with an interdisciplinary and diverse team. As noted above, our project will (**goal 1**) co-develop the *Libraries Count* program with key stakeholders from a culturally-responsive, strengths-based perspective in diverse settings; (**goal 2**) pilot, evaluate, and iteratively improve the program in two states, TN and AL; (**goal 3**) roll out and evaluate the impacts of the program at scale through WebJunction across our two pilot and either additional states (that include AZ, CA, CO, MA, ME, MD, NJ, NY, and; (**goal 4**) publish the final *Libraries Count* program on WebJunction for libraries to access for free nationally. The research component will also produce new knowledge about the effectiveness of the co-development process, and how well the *Libraries Count* program builds the capacity of library staff and families in supporting early math.

Figure 1. Children constructing 2-dimensional shapes (geometry) with pretzel sticks.

PROJECT WORK PLAN

This Project Work Plan includes a description of the project objectives that will help address the interrelated goals and research questions, describes the specific activities aligned with the timeline, and provides an overview of the budget.

Program Objectives. We have indicated the alignment between the objectives and our research questions in parentheses below.

Objective 1. For all collaborators [library staff, diverse families, development team] to learn from the co-development process about the views and perspectives of various stakeholders around what is early math, in a variety of contexts, how to engage diverse communities. (RQ1)

Objective 2. To assess and evaluate throughout the project (Year 1 through Year 3) the extent to which library staff and diverse families perceive *Libraries Count* to be applicable to their own lives and is meeting their needs relevant to their context, culturally responsive, and to offer equitable learning opportunities? (RQ2)

Objective 3. Increase knowledge of library staff after participation in the *Libraries Count* program based on interactions with diverse stakeholders. This includes knowledge such as what is early math in terms of what content and skills are involved, why it is important for all young children, why we need to think broadly about what early math is, cultural contexts, and the assets families bring that may not be "traditional" math, how to support early math with young children in library programming, how to engage families in this work. (RQ3)

Objective 4. Influence views of library staff through participation in *Libraries Count,* such as those related to self-efficacy, misconceptions, and math anxiety; what math looks like and how it can be done appropriately for young children; noticing that we can talk about, think about, and do math anywhere, anytime, and opportunities to include more math in library programs and with children at home are accessible to anyone. (RQ 3)

Objective 5. Changing practice of library staff by increasing quantity and quality of early math content in library programming, which will lead to increased knowledge and confidence of families, and ultimately, enhancing early math and literacy connections and learning for young children across their ecosystems. (RQ 4)

Specific Activities & Timeframe. The team will carry out the specific activities described below across the 3 project years in order to meet our goals and objectives. See also the Schedule of Completion for additional details.

Year 1. Planning, hiring, contracts, form teams (Activity 1). The PI has already started the application for IRB approval for this proposed research project through ETSU's IRB board so that we will have approvals in place prior to August 1, 2022. The application will be submitted by the end of April. Early in Year 1, we will complete hiring, contracts, form teams (e.g., Diversity, Equity, Inclusion, or DEI team), and begin to plan for the coming year. Leadership Team Meetings (Activity 2). The Leadership Team will meet on Zoom regularly across the life of the project, and will connect in person when possible (e.g., at conferences). Collaborative Co-Design/Teams/WebJunction Meetings (Activity 3). The collaborators will participate in virtual bi-monthly meetings in the first 9 months to identify strengths, co-create the structure for the training and initial modules (note we will decide what constitutes a 'module' in collaboration with the co-design team and with WebJunction), formalize plans for TN and AL pilot, conduct expert content review, and collect initial data. The goals of this work will be to determine the scope and sequence of training, building on our initial framework (see Appendix A) and existing knowledge; ensure professional learning program is adaptable, sustainable, and culturally-responsive; draft modules; create assessment questions for modules. Build & Revise *Libraries Count* Modules (Activity 4). The work to build and revise modules for *Libraries Count* will begin in Year 1 and continue in Year 2.

Recruit and pilot test with library sites (Activity 5). In the last 3 months of Year 1, we will recruit library staff to participate in the pilot of our initial modules in TN and AL. We will make modifications based on results, begin creating new modules, and plan to roll out revised modules to our expanded network of libraries in Year 2. Research: (Activities 6-8). Research will begin in Year 1 with initial activities such as confirming all IRB approvals are in place, planning for data collection and finalizing instruments. Any modifications to IRB will be sought at the end of each project year. Dissemination: write/prepare/present (Activity 9). We will disseminate information about our project throughout in conjunction with WebJunction, with activities later in the grant to report results of research and share information about the available program.

Year 2. In this year, we will focus on a cycle of piloting and revising the modules with library partners, with input from diverse families at national partner sites. The teams will create new modules, then roll out online modules to sites for testing. By the end of Year 2, we will have the full training modules revised based on formative feedback. Research and dissemination are ongoing.

Year 3. Library staff at the 10 partner sites across the United States will participate in the full training and complete pre- and post-assessments and surveys to assess impact. In the last 6 months of the proposed project, we will make final revisions to the program, complete dissemination efforts of research findings, and prepare to publish the training modules for free on WebJunction. Across all years, we will disseminate what we learn, continually evaluate our progress and revise as needed through feedback surveys and Advisory Panel input (Performance Measurement Plan), and collect, analyze, and report on research findings.

Collaborators & Teams. The project will be led by the Leadership Team, in partnership with an Advisory Panel, additional teams, WebJunction, and libraries and library systems across 10 states. Members of the Leadership Team and the Advisory Panel will contribute to project teams as described below. Our vision is that the teams will work together during the project, focusing on specific aspects of the program, to divide roles and to work efficiently. The voices (perspectives and contributions) of the target groups are built into our project by design. All participants will provide ongoing input, feedback, validation, and consensus-building through an open discussion and dialog and a formal system of requesting feedback in our iterative design process. We will track progress of our project towards intended results by collecting formative data (see Performance Measurement Plan) and using results to make changes when needed. We also will disseminate our project findings in a variety of ways, described in the section below "Broad Impact & Partners for Dissemination." All participating members of the project team will be provided with a stipend for their work (see details in Budget Justification).

Leadership Team. PI. Alissa A. Lange, Ph.D. Assoc. Professor in Early Childhood Education, Director of the EC STEM Lab, creator of Math and Science Story Time (MASST), Family Math Practice Network member, PI of early math and STEM projects, co-facilitator of the NAEYC Early Math Interest Forum, ETSU (TN). Co-PI. Bharat Mehra, Ph.D. Professor & EBSCO Endowed Chair in Social Justice, School of Library and Information Studies, University of Alabama, PI on several IMLS grants in the Appalachian region involving training and rural libraries (AL). Carol Trivette, Ph.D. (senior personnel) will lead our family engagement efforts, Kwangman Ko, Ph.D., will leverage advanced statistical expertise to consult on research, and we will hire a Project Coordinator as well. The members of the Leadership Team will lead and manage all aspects of the project. This will include essential efforts to create the content based on the input from the collaborators, responsibility for delivering content to review, and maintaining a consistent voice across the modules (e.g., establish outcomes for the learner; writing content that aligns with the outcomes, such as text, scripts for videos, exercises).

Figure 2. Math and Science Story Time (MASST) Program at New Brunswick Free Public Library

Advisory Panel Name, Expertise, Affiliation (State). Margaret Caspe, Ph.D., expert in family engagement with libraries and communities, co-creator of the 5Rs model, lead member of the Family Math Practice Network, The National Association for Family, School and Community Engagement; Doug Clements, Ph.D., world-renowned early math expert including seminal work on geometry and learning trajectories, University of Denver (CO); Hannah Lakin, STEM Education Specialist in informal learning, rural communities, MMSA, (ME); Kristen Reed, former math educator, current math teacher educator at Young Mathematicians at EDC, Boston (MA); Savitha Moorthy, equity and early learning, Executive Director of Tandem, San Francisco (CA); Kate Green Smith, Youth Services and Special Projects Coordinator, TN State Library and Archives, Nashville (TN); Nancy Pack, Ph.D., Director of Alabama

Public Library Service (AL); Kendra Davey, Literacy Initiatives Program Manager, Community Engagement Office, Pima County Public Library, Tucson (AZ); Karen Stuppi, Children's Librarian, New Brunswick Free Public Library - original site of Lange's MASST program when she was at Rutgers University (see Figure 2) (NJ); Sharon Phillips, NY State Libraries (NY); Mega Subramaniam, Ph.D, expert in library & information science professional learning, University of Maryland (MD).

The members of the Advisory Panel will be consulted as needed. Their roles and responsibilities may include:

- Provide feedback during various stages in project development
- Supporting ongoing evaluation and assessment of all grant activities
- Attend virtual meetings with the team to co-develop modules (as needed)
- Assist with recruiting library sites to partner, test, and revise modules. The pilot site staff will be expected to work with the team to engage in the training and provide feedback for revisions.
- Assist with recruiting families to provide input on the co-development process

Additional Teams. The *Libraries Count* project will be organized according to the following teams based on content, led by members of the Leadership Team and involving Advisory Panel members and consultants: *Families & Communities Team; Diversity, Equity, Inclusion Team; Content Development Team*; *Research Team, Instructional Design & Professional Learning Team.* Members in these teams might include Advisory Panel members and others who will be elicited to participate if the grant is funded. They will be involved in the grant based on levels of commitment, expertise, and needs of the project. These teams will enable the project to work efficiently, grounded in the strengths of members.

Pilot Library Staff. We will identify library staff who will participate in the *Libraries Count* training and provide feedback to test out the modules across all 3 years in the 10 partner states.

Consultant. OCLC's WebJunction will support instructional design for online learning, hosting the final program. Ongoing collaboration with WebJunction will guide the process of taking *Libraries Count* from ideas and content to online delivery. Regular meetings will be held between WebJunction and the Leadership Team, in combination with additional teams, as needed (e.g., *Instructional Design & Professional Learning Team*).

Theoretical Framing. The 5Rs framework [3] (Ideabook) of family and community engagement, our evidence-based approach to professional learning [10], and research and resources on early math development (e.g., learning trajectories) and math with families (e.g., Young Mathematicians) guide our collaborative work. The 5Rs [3] (described below) and our emphasis on community engagement and social justice will frame progressive changes to meet underserved needs [11,12,13,14]. We will build on prior IMLS-funded projects, such as Reimagining School Readiness by diving into one critical domain in STEM (math) to build deep understanding through transformative and well-designed virtual professional learning. Our WebJunction partners are well-versed in instructional design for online learning.

Operationalizing Theoretical Frameworks. What makes *Libraries Count* unique is that the project bridges divides across theoretical constructs and librarians' practice world via praxis-based (i.e., critical and reflective) decision-making to inform positive social changes in the workforce and in their embedded communities (Freire; Schon; Mehra). The process helps inform the design and development of tangible deliverables (i.e., the online professional learning program with the training modules) for library and archives professionals as they engage with underserved stakeholders (e.g., young children and their families from diverse backgrounds) while operationalizing principles of social justice (i.e., fairness, justice, equity/equality, change agency, and empowerment) via their interactions. Reaching out, raising up, reinforcing, relating, and reimagining (i.e., The 5Rs) drive every step and activity conducted during the grant in order to strengthen relationships between various collaborating constituencies.

Extending the traditional modes of practice of library and archives professionals (e.g., inward-looking foci, neutrality, passive bystanders while community dynamics unfold, etc.) to reach out, relate to, work with, and support young

children and families living in traditionally disenfranchised communities provides potential for this project to reinforce existing strengths and reimagine the future in generating local, regional, and national impacts. For example, all the goals of *Libraries Count* establish its mission and lay out the directions for the grant activities, design elements, and procedures towards this end. RQ 1 promises the operationalization of the 5Rs at the meta-level in its entirety as a holistic vision inclusive of the various components and participants (external and internal to the library). RQ 2 focuses on the 5Rs delivered in terms of potential impact on lives of constituencies external to the libraries (i.e., diverse families and children) via the interactions between the diverse families and library staff while RQ 3 and RQ 4 identifies the applications of the 5Rs for the stakeholders internal to the library (i.e., its staff). The objectives in *Libraries Count* provide a roadmap and potential evaluation mechanism to help meet these goals adopting and integrating the 5Rs in the detailed design process throughout the grant.

All the objectives were created reflecting the SMART acronym (i.e., specific, measurable, action-oriented, realistic, and time-bound) [see Project Work Plan]. Checks-and-balances in the form of evaluation and assessment will be conducted throughout and at every stage in the project to ensure we are making adequate progress as described in the proposal (see Performance Measurement Plan). Any gaps that emerge will be addressed right at that point to make sure the planned steps do not get derailed. Contingencies owing to COVID-19 stipulations and other unforeseen expectations will be accounted for in our responses and efforts moving forward from when those requirements emerge. We plan for a primarily virtual meeting and training interface, so most of the issues related to this will be averted.

Research Methods. This section outlines the design and details of our research plan. Our proposed project is relevant for current practice because, a) early math is critical to young children's educational trajectories [1], b) this content is not commonly incorporated into library programming for young children, and c) we can build on the field's knowledge about effective professional learning, such as how it must tie into practice for sustained impact [15].

Design. We will use a convergent mixed methods research design [16] as we collect qualitative and quantitative data simultaneously across the life of the project and analyze merged data to answer our RQs.

Participants. The participants in the research include all members of the Leadership Team, co-development group, and Advisory Panel in Year 1, as we work to answer RQs 1&2. Our library partners will work with us to recruit participants, including families and library staff for the pilot and for the larger evaluation. We expect 10 library staff (5 per pilot state) to pilot in Year 1, 50 (5 per 10 partner states) to pilot and offer suggestions to draft modules in Year 2, and 200 library staff (20 per 10 partner states) to participate and test the full program in Year 3. The Leadership Team will support partners in this recruitment process, for example by creating recruitment flyers and sign up sheets. The participants involved in helping us to answer our RQs 3&4 will be the library staff who will participate in *Libraries Count* in Year 3. We expect approximately 200 library staff across 10 states working in a variety of library settings and library systems to participate in this Year. Will will aim to recruit library staff who represent a diverse range of contexts, states, and settings in order to increase the generalizability of our findings.

Instruments. Assessments with evidence of reliability and validity will be identified where possible (e.g., KMD [17]) and created (e.g., test items aligned to module content; feedback surveys) in the first 6 months of the project. We will discuss using innovative analyses approaches, such as the factorial vignette design, which uses mixed methods to measure attitudes and beliefs constructs [18]. Ko is experienced in using this approach. The PI and the broader team have extensive research experience related to assessment psychometrics, measurement, and qualitative and quantitative data collection & analysis.

Data Collection & Analysis Plan. *Quantitative Approach*. A power analysis was conducted using G*Power [19] to identify the minimum sample size required in Year 3 to measure impacts on library staff of participation in the final program. Using a power of .8, a *p*-value of .01 (to adjust for multiple outcomes, two-tailed analysis), a MDES of *d*=.4, we would

need a sample size of 65 library staff. Our plan for 200 is well above that figure, and allows room for subgroup analyses and attrition, although we expect the attrition rate to be low considering participants will get an incentive to complete the training and because we have committed state partners to support library staff. Our primary quantitative analysis technique will be a one-way MANCOVA, with post-training scores (e.g., module-aligned test items; measures of attitudes & beliefs) as outcomes, and pre-training scores, state, and demographic characteristics of library staff as covariates. This is because we will have multiple outcomes and wish to increase the precision of our estimates by controlling for extraneous variables. Other quantitative data will supplement our primarily qualitative research in Years 1&2, such as responses to items using Likert-type scales related to perceptions of the value of the co-development process and the module revisions. These results will be merged with qualitative data to answer the RQs.

Qualitative Approach. The entire duration of the *Libraries Count* project provides a real-life laboratory in a professional setting to gather rich, insightful, and valuable qualitative datasets. These will be structured in form via formal, informal, ethnographic, and participatory data collection efforts across the three years of the grant. The purpose is to represent a plurality of perspectives and experiences collected from multiple stakeholders. For example, during Year 1 data will be gathered from rigorous note-taking, agenda compilation, and meeting minutes (1-6 months), in addition to online interviews, focus groups, written reports, and participatory observations during the pilot testing of the modules in TN and AL (10-12 months). Similarly, during Year 2 and Year 3 some of the methods tested earlier will be tweaked to operationalize for the remaining eight states. In addition, the quantitative tools of surveys and pre-and-post assessments during Year 3 will include comment boxes for open-ended data collection. The qualitative data analysis will be guided by grounded theory [20] and involve deductive coding (e.g., open, selective, axial) as needed to identify categories and themes as well as specific actions to be implemented as a result of recording the phenomena of experiences getting recorded. We will utilize various strategies to check trustworthiness, reliability, and validity of data findings such as triangulation, member checks, reiterative assertions, and application to next steps.

Evaluation. Advisory panel members and others will be requested to share input on the project progress annually/bi-annually. The Project Coordinator will be responsible for checking our progress against the stated timeline (see details in the Performance Measurement Plan), and the co-developers involved in the project will be giving us ongoing feedback, which will feed into our evaluation of the 'effectiveness' of the deliverables.

Broad Impact & Dissemination. Libraries and library systems across 10 states have agreed to co-develop, pilot, and disseminate the program. The Association of Rural and Small Libraries (ARSL) and the Collaborative Summer Library Program (Smith) have agreed to help disseminate through through their listservs, and we will promote using our collaborators' platforms, such as ConnectedLib (Subramaniam), Young Mathematicians (EDC), and EC STEM Lab (Lange). Given the focus on children's programming, the *Libraries Count* project team would continue conversations with the Association for Library Service to Children (ALSC), with the goal of information sharing across their network as well. *Libraries Count* will be available for free through WebJunction, and research results will be published in multiple outlets each year to reach a broad audience, including library researchers, practitioners, and families.

In addition, across each project year, we will enact a communications plan. We will pull in our team's expertise to formulate the plan at the start of Year 1, but some initial ideas are as follows. We will identify libraries or library staff who are particularly enthused about the program to highlight in each year, such as through short blogs or video clips. We will ensure we capture practitioner voices as we work to build up excitement in our work, share information about the value of early math, and highlight ways in which our program will be built to serve libraries in different regions and to work with different populations. In addition, we will use various social media outlets, leveraging media resources at the host institutions and partner organizations to disseminate various aspects about the project during its various stages. The PI has been partnering with media students on campus to expand the social media and online presence for her early STEM projects, and will leverage this knowledge to ensure *Libraries Count* can reach the most people. We will share resources on the EC STEM Lab website and social media accounts across the project, including press releases,

events sharing, links to online modules, and we will archive and disseminate through our institutional repository and project website. WebJunction will also share resources during the project's development phase.

Budget Summary. Direct costs: (1) ETSU Salaries-faculty (Lange, Trivette, Ko)=$50,281; staff (Ridley, TBD grant support)=$7,723; (2) Fringe=$23,080, (3) Travel=$6,000; (4) Supplies (printing, transcription)=$1,350; (5) Subaward (Mehra, co-PI)=$103,797 (6) Doctoral fellow (stipend & tuition)=$20,513; (7) Other costs (WebJunction, consultants, advisory panel & library partner stipends)= $96,000; (8) Total direct costs= $340,880; (9) Indirect costs=$126,707 (10) Total project costs=$467,587.

DIVERSITY PLAN

Our work will be guided by both a strengths-based approach and a social justice lens [21,22,23,24,13], grounded in the belief that we all have strengths and we must include all voices in this work. Members of the DEI team, led by the Co-PI (Mehra) will contribute to program development and revision, ensuring that our program will be relevant for library staff, families, and children, and that our program will be flexible to work in diverse contexts. We will build on the project team's past work around early math and professional learning (Lange, Clements, Young, Reed), training with libraries in rural and diverse communities (Mehra, Lakin, Subramaniam, Davey, Smith), and reaching families from diverse backgrounds (Mehra, Caspe, Trivette, Moorthy). All team members are chosen to help the program meet diverse underrepresented needs of communities across the country.

The conceptualization, planning, design, organization, and implementation of *Libraries Count* provides an opportunity to operationalize social justice in ways that are systematic, intentional, community-engaged, and impact-driven leading to development of inclusive and equitable practices [25]. "Diversity" is not treated in this proposal as a lip-service token construct; integration of diverse voices throughout the project design during all its stages serves as the driving force of the grant. For example, the DEI Team in collaboration with the Families & Communities Team will be inclusive of different project stakeholder groups and ensure that formative, summative, and participatory feedback and evaluation is provided throughout the project stages. These include the stages of co-creation of the training modules (year 1: months 1-6), testing in the pilot states (i.e., during year 1: months 7-12), and operationalizing and module development in the expanded library network around the country (year 2 and year 3). Lessons learned during *Libraries Count* will help train our own project's internal team as well as the broad diverse workforce of library, archives, and other professionals to better create and deliver information resources and programming (i.e., online professional math learning program) that are responsive to the diverse needs of traditionally underserved user communities (i.e., for diverse young children ages 3-5, and their families).

Libraries Count represents a strong geographical diversity in its process of initial pilot testing in two states (i.e., TN, AL) followed up with operationalizing the modules development in the remaining eight states (i.e., AZ, CA, CO, MA, ME, MD, NJ, NY). The pilot states were selected since they are the location of the home institutions of the PI/co-PI and have provided strong opportunities for establishing and consolidating professional networks and community impacts in STEM and diversity-related research. The East Tennessee State University and the University of Alabama and the units of the PI/co-PI within these academic settings have illustrative missions and strategic plans that integrate diversity, equity, and inclusion as significant priorities in shaping their activities and resource allocations. The strategy to include an extensive distribution of the eight states from around the country in *Libraries Count* was a deliberate act. It was based on applying relevant selection criteria, including potential impact in synchronization with the grant's goals/objectives, need and contextual directions in the areas of work pursued in the regions, effective topical development and expertise, and possibilities of tapping into professional networks to generate meaningful outcomes, amongst others. For example, our AZ partner's library systems serve a significant portion of Latinx families and children, while TN and AL include a number of rural communities. The co-creation and design process in *Libraries Count* was developed in bringing these elements together in a thoughtful plan that gave strong consideration to principles of equity, impact, and diversity of voices.

PROJECT RESULTS

The Project Results include a description of the final professional learning program deliverable, a tentative roadmap for the team as a starting point in co-developing the professional online learning program, and ways in which the program will advance understanding, benefit society, adaptable, and sustainable.

Intended Results. This project will result in an online professional learning program, *Libraries Count*, that will build the capacity of the library staff by increasing their knowledge about what early math is and how it develops, how language, literacy, and math are linked [9], and their confidence in supporting early math within programming, and to support diverse families to feel confident with math at home. We will build on strengths-based approaches to early math with families (e.g., Family Math Movement), IMLS-funded projects mentioned above, and existing research [6].

The project results are directed towards generating impacts on multiple stakeholders, including: 1) Young audience and their diverse families: Having an opportunity of inclusion in the co-design process towards development of an online professional learning program for early math education will provide voice to an underrepresented group traditionally excluded in the process. 2) Library staff in the partnering institutions: They will be able to test and operationalize resources that are urgently needed in helping them generate extended impacts. 3) Co-development design team: They will be able to learn from the coming together of various views and perspectives of multiple stakeholders towards a stronger product. 4) Professional library community: Through dissemination of the project experiences, product design, and grant results the professional library community will gain in possible replication and application in similar situated settings. 5) Math educational contexts & educators: The early math education and teaching ecosystem (e.g., elementary schools; preschools; home schoolers; science museums, etc.) will be able to get support from public librarians through dissemination and in future initiatives to apply their insights from this grant to work with diverse stakeholders in their own constituencies.

This project will address the needs noted above by empowering adults in young children's lives in libraries and families. We will advance understanding of how early math professional learning can enact change in practice. This project will provide a social benefit because of the multipronged impacts on the targeted and beneficiary populations, noted above.

Project Deliverables. The final *Libraries Count* online professional learning program is the primary deliverable. It will consist of content described below. The program will be adaptable, generalizable, and usable by other institutions and communities nationally because our project will co-design *Libraries Count* **with** the end users as part of the development team during the first year. The program will also allow for individualization of the program for different contexts because our 10 state partners will provide feedback to the team so that our program will be successful in a variety of contexts. In addition, our team will submit at least one manuscript reporting on our research findings to a peer-reviewed journal.

Content: We will work with our team of families, library staff, and content experts/researchers to co-create the content and format in the first year, with the extensive existing evidence-based early math resources (e.g., Khan Academy; Bedtime Math; DREME Network; Learning Trajectories) and knowledge about effective professional learning in early math [26] as a guide.

Initial plans include modules focused on major domains of math, such as number and geometry. Module structure may include an overview of what early math is, how it develops, the importance of reflecting on families' and children's cultures in supporting early math, and how it relates to early literacy and language (e.g., [10]), with examples grounded in children's literature (e.g., measurement basics like comparing our bodies to the life size illustrations of animals in the book *Actual Size* by Steve Jenkins - see Figure 3; spatial reasoning discussions emphasizing position words with the book *There's a Bear on my Chair* by Ross Collins), tips for supporting children's and families' math thinking, doing, talking, and reading within libraries (e.g., number composition with toy bears and chairs), practical ideas to infuse early math

content into current library programming (e.g., family math nights), and links to free resources (e.g., book, non-book activities; virtual learning tools).

Tentative roadmap. A draft outline for the *Libraries Count* professional learning (or development) product is below; details for one example are in Appendix A. Note that this is a start that is grounded in vast early math research, and the number of modules, the program content, and the structure will be decided collaboratively in Year 1.

- Overview of training; why this project; components; goals.
- Early Math: What, Where, & Why? What is it, how does it develop, growth mindset for learning, thinking and problem-solving; benefits for library programs; families matter, math anxiety.
- Who? Equity, inclusion, diversity, and access at the heart; The 5Es approach to working with families, libraries, and communities.
- Number: Not just counting.
- Space and Geometry: They're all around us.
- Measurement and Data: Which book is your favorite?
- Operations and Algebra: Wholes and parts.
- Patterns & More: Repeating phrases in books.
- How? Integration and expanded examples.
- Where from here?

Figure 3. Boy comparing length of his tooth with the saltwater crocodile's in *Actual Size.*

Section	Subsection	Text	Image(s)/Interactive Elements
Welcome	Project name	*Libraries Count* is a free professional learning program for library staff, developed in collaborative effort	Our logo
	Project Purpose	Build capacity of library staff to include more math in library programming	Library staff member holding up 3 fingers, alongside a book of 3 Little Pigs
	Libraries Count Objectives	This program will share -**Importance.** The importance of early math for later learning -**Strengths.** What we bring as adults in children's lives to make a difference -**Equity.** The critical importance of a strengths-based approach, considering equity, diversity, and inclusion in our work with families, children, and how we think about what math is and looks like with young children	Clickable cards for each bullet that flip over with description text when clicked.

Figure 4. Possible structure details for the *Libraries Count* product (see Appendix A for full version).

Sustainability. This project will be sustainable because it will be available for free on WebJunction once development is complete. Because it will be free, that will make it accessible broadly. We envision sections to be built into the co-design of *Libraries Count* that will allow for individualization of the program for different contexts. For example, some library systems might like to include a more in depth study of the content, so they may choose to require work outside of the clock hours that the online program involves.

While the EC STEM Lab website will maintain and disseminate project news and development during the grant duration, the project website supported through the ETSU institutional repository will archive the *Libraries Count* online professional learning program and modules for at least three years (or links to the WebJunction resource) once the project is completed.

SCHEDULE OF COMPLETION

YEAR 1

#	Description	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23
1	Planning, hiring, contracts, form teams												
2	LT Meetings												
3	Collaborative Co-Design/Teams/ WebJunction Meetings												
4	Build & Revise LC Modules												
5	Recruit and pilot test with library sites												
6	Research: final IRB approval/ mods; finalize data collection plan and instruments												
7	Research: collect & analyze data												
8	Research: evaluate full program												
9	Dissemination: write/prepare/ present												

		YEAR 2											
#	Description	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24
1	Planning, hiring, contracts, form teams												
2	LT Meetings												
3	Collaborative Co-Design/Teams/ WebJunction Meetings												
4	Build & Revise LC Modules												
5	Recruit and pilot test with library sites												
6	Research: final IRB approval/ mods; finalize data collection plan and instruments												
7	Research: collect & analyze data												
8	Research: evaluate full program												
9	Dissemination: write/prepare/ present												

		YEAR 3											
#	Description	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25
1	Planning, hiring, contracts, form teams												
2	LT Meetings												
3	Collaborative Co-Design/Teams/ WebJunction Meetings												
4	Build & Revise LC Modules												
5	Recruit and pilot test with library sites												
6	Research: final IRB approval/ mods; finalize data collection plan and instruments												
7	Research: collect & analyze data												
8	Research: evaluate full program												
9	Dissemination: write/prepare/ present												

Digital Products Plan

Type

The Libraries Count online professional learning program will consist of online training that will be self-paced, and include interactive content like pages that provide information, images showing interactions, quiz items, and follow up questions (although note that we will not know specifics until we co-develop the program in the first year). We do know that it will be interacted with online and there may be additional documents, like PDFs that library staff can download and print out. Library staff can interact with the online content for free through WebJunction. Any components that are posted online will be free to use and openly licensed with a Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) license. Research data will not be provided publicly initially, but datasets will be provided in accordance with IMLS requirements for free once research results have been published.

Availability

We agree that all content created for the project will be licensed as CC BY-NC 4.0 so that the content is widely available. For our research papers, we will aim for open access electronic journals as outlets. This will increase the reach of the work.

Access

The *Libraries Count* online professional learning program will be openly available online hosted by WebJunction with the use of standard browsers. Any associated documents will be downloadable from WebJunction, and the PI's website, where applicable.
This digital product will not implicate privacy concerns or cultural sensitivities.

Sustainability

WebJunction has agreed to host the final program and associated documentation beyond the life of the project. ETSU has plenty of storage space to save project files securely through their secure Onedrive system. The PI's website will also host related documentation, and the website is a part of her EC STEM Lab work through ETSU, so that site will be able to continue to share documents with limited organizational funding.

DATA MANAGEMENT PLAN

• Identify the type(s) and estimated amount of data you plan to collect or generate, and the purpose or intended use(s) to which you expect them to be put. Describe the method(s) you will use, the proposed scope and scale, and the approximate dates or intervals at which you will collect or generate data.

Data types
This project will collect and analyze a variety of data types, including both quantitative and qualitative data, from a variety of sources as described in the narrative. These include, but are not limited to, sources such as:

- Participants responses to surveys distributed online through Qualtrics to measure constructs of interest (e.g., quiz questions including questions with content aligned to modules), before and after use of Libraries Count – qualitative and quantitative sections
- Meeting minute notes (e.g., from Advisory Panel meetings, focus groups), taken during meetings, transcribed for analysis – qualitative
- Feedback surveys from participants on strengths, weaknesses, effectiveness of project activities or resources (e.g., library staff reviews of the program and its relevance to their contexts) – qualitative and quantitative

• Will you collect any sensitive information? This may include personally identifiable information (PII), confidential information (e.g., trade secrets), or proprietary information. If so, detail the specific steps you will take to protect the information while you prepare it for public release (e.g., anonymizing individual identifiers, data aggregation). If the data will not be released publicly, explain why the data cannot be shared due to the protection of privacy, confidentiality, security, intellectual property, and other rights or requirements.

We will need to collect PII in order to link pre- and post-participation data. However, once the data are received, they will be blinded and assigned an ID code. This code will be linked with a key, which will be stored separately from the data files. The blinded quantitative data set will be made publicly available once all journal manuscripts have been submitted for publication. Qualitative data will be more difficult to share, due to the nature of the data, likely being so descriptive and potentially being identifiable with certain sites or people. We are open to trying to share these, however, our first priority would be to protect the confidentiality of the participants, so we would prefer to share the quantitative data only, if IMLS approves of that decision.

Ethics and Privacy: The consent process will inform participants that the data they are providing will be used and shared with the research community. All data will only ever be published in aggregate, and participant quotes will be used anonymously. Surveys will necessarily include participant identifiers to facilitate correlation between various data sources, but any possible identifying information will be de-coded. Further information about ethics and privacy will be available through our existing Institutional Review Board documentation at East Tennessee State University.

• What technical (hardware and/or software) requirements or dependencies would be necessary for understanding retrieving, displaying, processing, or otherwise reusing the data? How can these tools be accessed (e.g., open-source and freely available, commercially available, available from your research team)?

Initial data collection will use Qualtrics and Microsoft Excel spreadsheets for all surveys. Primarily quantitative data analysis is likely to be in SPSS. This program is a commercial product. However, once the dataset is ready to be shared, it can be saved as an Excel document, and therefore easy to make accessible, such as through Google Docs - spreadsheets.

In order to ensure qualitative data is meaningful and accurate, researchers will individually code data sets and then meet to discuss emerging themes using Atlas.ti. Minutes from virtual Advisory Panel meetings will include information

such as the date and attendees when entered into data analysis programs. Quantitative data will also be analyzed through SPSS retaining metadata. Researchers will use metadata standards such as mutually agreed upon formats for documents and data reports.

• What documentation (e.g., consent agreements, data documentation, codebooks, metadata, and analytical and procedural information) will you capture or create along with the data? Where will the documentation be stored and in what format(s)? How will you permanently associate and manage the documentation with the data it describes to enable future reuse?

Initial data collection will use Qualtrics and Microsoft Excel spreadsheets for all surveys. Primary data will be created *de novo* in SPSS or transcribed into the qualitative data analysis program, NVIVO. Metadata will be kept in variable view in SPSS data files. *Storage and Access.* Files will be stored and available both in original format and as .pdf documents. Data will be stored in both .pdf and tab-delimited formats for the purpose of subsequent statistical analyses. Additionally, data generated by the project and website will include ASCII, Microsoft Office formats including Word, Excel, and PowerPoint, Google Drive Documents including Document, Sheet, or Form, pdf, HTML, CSS, PHP, and video and image files.

In order to ensure qualitative data is meaningful and accurate, researchers will individually code data sets and then meet to discuss emerging themes. Minutes from virtual Advisory Panel meetings will include information such as the date and attendees when entered into data analysis programs. Quantitative data analyzed through SPSS will retain metadata. Researchers will use metadata standards such as mutually agreed upon formats for documents and data reports. Data will be stored on secure ETSU Onedrive servers, and sources of data will be saved with the aforementioned key. The project coordinator will assist in keeping files organized for the purpose of future reuse, in conjunction with the PI.

• What is your plan for managing, disseminating, and preserving data after the completion of the award-funded project? If relevant, identify the repository where you will deposit your data. When and for how long will data be made available to other users?

Storage and Backup: To ensure ongoing and long-term security of the data generated by this project, a complete copy of materials will be generated and stored independently on primary and backup sources for the PI (as data are generated) on the network drive at East Tennessee State University. Hard copies of the evaluation data will be stored in file cabinets under triple lock for up to five (5) years after the study. Data stored on the server at ETSU is backed up on a weekly basis, and the PI will also save data that collected in original form through online surveys to an external drive.

Archiving and Preservation: Complete data will be archived in co-PI's office, under triple lock. We will work with ETSU Sherrod Library Staff to ensure data is archived properly and deposited with high quality metadata. The results of our data management will also be included in the final project report.

• When and how frequently will you review your Data Management Plan? How will the implementation be monitored?

The data management plan will be reviewed every 6 months. The project coordinator will assist with this task as part of their regular duties in this role, and report to the PI and Leadership Team to keep us apprised of the plans for data collection, management, storage, analysis, and dissemination.

This Organizational Profile is for the lead applicant, ETSU.

• Your organization's mission or statement of purpose, noting the source, approving body, and date of the official document in which it appears

ETSU Mission & Values. ETSU provides a student-centered community of learning, reflecting high standards and promoting a balance of liberal arts and professional preparation, and continuous improvement. The university conducts a wide array of educational and research programs and clinical services including a comprehensive Academic Health Sciences Center. Education is the university's highest priority, and the institution is committed to increasing the level of educational attainment in the state and region based on core values where: PEOPLE come first, are treated with dignity and respect, and are encouraged to achieve their full potential; RELATIONSHIPS are built on honesty, integrity, and trust; DIVERSITY of people and thought is respected; EXCELLENCE is achieved through teamwork, leadership, creativity, and a strong work ethic; EFFICIENCY is achieved through wise use of human and financial resources; and COMMITMENT to intellectual achievement is embraced. ETSU endorses the value of liberal education and provides enriching experiences in honors education, student research and creative activity, study abroad, service learning, and community-based education. ETSU honors and preserves the rich heritage of Southern Appalachia through distinctive education, research, and service programs and is actively engaged in regional stewardship. ETSU affirms the contributions of diverse people, cultures, and thought to intellectual, social, and economic development. ETSU offers students a total university experience that includes cultural and artistic programs, diverse student activities, a variety of residential opportunities, and outstanding recreational and intercollegiate athletic programs. ETSU awards degrees in over one hundred baccalaureate, master, and doctoral programs, including distinctive interdisciplinary programs and distance education offerings that serve students from the region and beyond. (Approved by the ETSU Board of Trustees 3/24/17) Source: https://www.etsu.edu/president/mission.php

• Your organization's governance structure. ETSU is a non-profit regional public university that is governed by a Board of Trustees, has an on-site library – Sherrod Library, and partners with public libraries in our region and across the state.

• **Your service area**. ETSU is a regional public university that serves communities in our heavily rural Appalachian area, as well as urban centers situated in the TriCities area, such as Johnson City (population 63,152), where ETSU's main campus sits. ETSU has over 14,500 undergraduate, graduate and professional students.

• **A brief history of your organization, focusing on the organizational unit that will be directly involved in carrying out the work.** ETSU started as a teaching college in 1911, and has expanded to include 10 colleges and schools supporting students in a variety of disciplines. The PI is housed in ETSU's Clemmer College, which includes our education and educator preparation programs, in addition to other emphases. Clemmer is grounded in the mission of education, including professional development and learning. The PI's work at ETSU and in her EC STEM Lab has been committed to professional learning with adults in young children's lives particularly around early math and STEM since she started at ETSU in 2017, building on prior work with professional learning projects along with colleagues funded by the National Science Foundation.