



NATIONAL LEADERSHIP GRANTS FOR LIBRARIES

Sample Application LG-259132-OLS-25
Project Category: Planning

University of Oklahoma

Amount awarded by IMLS: \$150,000

The University of Oklahoma School of Library and Information Studies will examine the feasibility of integrating Generative AI (GenAI) into children's maker-based learning experiences in public libraries. The project will provide library professionals with curriculum and training to 1) improve children's informal STEM and participatory learning experiences and 2) enhance children's AI literacy through maker-based learning activities. Through this initiative, public libraries will become catalysts for innovative learning and offer scalable programs that empower the next generation to use artificial intelligence.

Attached are the following components excerpted from the original application.

- Narrative
- Schedule of completion

When preparing an application for the next deadline, be sure to follow the instructions in the most recent Notice of Funding Opportunity for the grant program to which you are applying.

Gauging Library Needs for Integrating Generative AI into Children's Maker-Based Learning

Introduction

The University of Oklahoma (OU) School of Library and Information Studies requests (\$150,000) from the National Leadership Grants for Libraries (NLG-L) for a **Planning Grant** for our **2-year** project that aims to investigate the needs and feasibility of integrating Generative AI (GenAI) into children's maker-based learning experiences, particularly under STEM (science, technology, engineering, mathematics), in public libraries. The project will explore how Large Language Model (LLM) enabled chatbots (e.g., ChatGPT, Microsoft Copilot) can be utilized better to address children's needs in hands-on maker-based learning activities, and at the same time, how maker-based learning can be used to promote children's AI literacy. This project will develop a preliminary curriculum for children's maker-based learning program (for ages 6-12) where they could learn how to communicate with a GenAI chatbot while learning how to make STEM artifacts (such as circuitry). Also, this planning grant project aims to establish partnerships with libraries to design and implement a curriculum and provide training for library professionals as learning facilitators for maker-based learning with GenAI. This project will adopt a mixed-method approach, consisting of needfinding interviews and surveys and iterative curriculum development, to address two questions: **RQ1:** What are the needs, opportunities, and barriers to integrating GenAI chatbot into public libraries' maker-based STEM education programming for children? **RQ2:** How can public libraries contribute to enhancing children's AI literacy through maker-based STEM programming?

The project will solidify partnerships for future implementation of a curriculum and advance knowledge in 1) improving children's innovative learning in STEM and AI and 2) enhancing library professionals' readiness to support children's AI literacy through maker-based learning. This project is well aligned with the NLG-L **Objective 1.1:** Serving the learning needs of the public through libraries. By combining human-AI interactions with hands-on maker-based learning, this project promotes a novel form of AI adoption in library environments and enhances children's STEM knowledge while equipping them with the knowledge to navigate and engage with AI thoughtfully. Through this initiative, public libraries will become catalysts for innovative STEM education and offer scalable and socially responsible programs that empower the next generation with essential AI and technological literacy.

Project Justification

Public libraries are critical in fostering informal STEM education, serving as accessible community hubs where children can engage in hands-on, creative learning experiences. Among the most impactful components of public library STEM programming are makerspaces and maker-based learning, which encourage open-ended exploration, problem-solving, and innovation through creating various types of physical and digital artifacts (Koh et al., 2015). Maker-based learning can provide access to tools such as 3D printers, robotics kits, and coding platforms, allowing children to engage in constructivist and inquiry-based learning experiences (Blikstein & Krannich, 2013; Halverson & Sheridan, 2014; Kafai et al., 2019). Unlike formal classroom instruction, which often follows rigid structures, public libraries and their makerspaces could promote experiential, self-directed, and collaborative learning on STEM and innovative technology. However, despite their educational potential, public libraries face challenges in meeting the diverse learning needs related to newer technology, such as AI, especially with constraints related to staffing, expertise, and resources.

Rationale 1: Enhance public libraries' capacity to support STEM and AI education by providing curriculum

One major challenge is the limited availability of expert guidance for children engaged in maker-based learning that integrates with varied domains. Many public libraries, especially those in under-resourced or rural areas, do not have dedicated STEM educators on staff, requiring library professionals—many of whom may not have specialized STEM training—to facilitate complex, technical learning experiences (Kim & Zimmerman, 2019). While some libraries have addressed this challenge by bringing in external experts or volunteers, these solutions are often temporary, inconsistent, and difficult to scale. Consequently, children often do not receive the appropriate support they need to fully benefit from hands-on learning opportunities, creating a gap between the potential and actual impact of makerspace STEM programs (Jung et al., 2023). Thus, developing a curriculum that public libraries can easily adopt and apply to their programming would benefit the quality of their services. IMLS has supported projects that aim to develop library programs and curriculums in STEM education. For example, [the STEM Pillars project from Pennsylvania State](#)

[University \(MG-77-16-0137-16\)](#) developed and implemented a number of STEM education curriculums with video resources for rural and smaller museums and libraries (e.g., Zimmerman et al., 2019). However, there have been yet many efforts to help libraries add AI literacy to STEM education programs. Aligned with the existing endeavors and the increasing importance of AI literacy, this planning-grant project could establish the basis for developing a series of curriculums that promote more effective STEM learning with GenAI.

Rationale 2: Promote AI literacy through hands-on, creative learning with making in public libraries

Public libraries are increasingly being called upon to promote AI literacy, yet most do not have the necessary resources, frameworks, or professional development opportunities to do so effectively (Casal-Otero et al., 2023). As AI technologies become ubiquitous in education, work, and daily life, it is essential that children develop a foundational understanding of AI concepts and how to use them appropriately and ethically. However, education about AI remains limited and inconsistent, with most existing efforts focused on basic coding programs or factual knowledge about AI (e.g., Xia et al, 2022; Yang, 2022) rather than critical engagement with AI-driven tools, except for a few pioneering works. An IMLS-funded project at Michigan State University developed AI education modules and webinars to enhance AI literacy for youth (teenagers) from economically underserved communities ([LG-250059-OLS-21](#)).

However, previous efforts in AI literacy have focused merely on AI without connections to real-life programs or other STEM learning content, but it has been increasingly important to support more advanced activities with AI, such as problem-solving, enhancing creativity, and decision-making across various domains with AI (Chee et al., 2024). Also, studies have not fully addressed how to support younger children (around elementary age) and their caregivers to appropriately use GenAI, such as LLM-enabled chatbot (e.g., ChatGPT). Without intentional guidance, children may adopt misconceptions about AI capabilities and limitations, reinforcing issues such as algorithmic bias, misinformation, and over-reliance on AI-generated content and recommendations (Murugesan & Cherukuri, 2023).

The integration of LLM-enabled GenAI into maker-based learning programs presents a compelling opportunity to address these challenges by providing real-time, personalized, and adaptive support for children engaged in STEM activities. GenAI chat systems can serve as interactive learning companions, helping children troubleshoot technical issues, brainstorm creative solutions, and access relevant STEM information at their own pace. Additionally, these systems can be designed to promote ethical AI literacy, equipping children with the skills to engage with AI critically, responsibly, and creatively. However, despite the potential benefits, there are currently no established models, best practices, or systematic evaluations of how GenAI can be effectively and ethically integrated into library-based learning environments. Thus, this project aims to fill this gap by conducting a rigorous needs assessment, participatory design process, and pilot implementation, ensuring that AI-enhanced maker-based learning is both educationally meaningful and ethically responsible. By exploring the needs, opportunities, and challenges of incorporating GenAI chat systems into public library makerspaces, this project will generate actionable insights for libraries, educators, and policymakers. In doing so, it will support libraries in their evolving role as community learning hubs, ensuring that children, regardless of background, can access high-quality, personalized, and AI-enhanced STEM learning materials and experiences.

Rationale 3: Explore the potential of GenAI in supporting maker-based learning in public libraries

Another significant challenge for public libraries' STEM and AI education is the wide variation in children's learning preferences, experience levels, and background knowledge in maker-based activities. Some children enter makerspaces with strong prior exposure to STEM concepts, while others—especially those from historically underserved communities—may be engaging with technology-based learning for the first time. This can be particularly problematic when children encounter troubleshooting challenges in maker projects, such as debugging a coding script, wiring a complicated circuit, or refining a 3D print model. Without immediate, context-aware guidance, children may become disengaged, or unable to fully complete their projects.

The lack of personalized, adaptive learning support in many makerspaces makes it difficult for library professionals to tailor instruction to individual needs. Younger learners, children with disabilities, and children with limited English proficiency may require additional scaffolding and differentiated instruction to fully participate in maker activities. However, in a typical library setting, where one or two library staff members may be responsible for facilitating activities for a large group of children, providing this level of individualized engagement is often unrealistic. In this circumstance, the use of GenAI could potentially provide additional support for library professionals as they organize and run programs for children. GenAI has the potential to complement library professionals' facilitation by offering

adaptive, interactive support. GenAI with LLMs may help people engage in personalized dialogues, provide creative prompts, and facilitate problem-solving activities (Zhu et al., 2022), thereby enriching children's maker-based STEM learning. Studies explored the potential use of AI in makerspaces, such as for a new algorithm to detect any safety issues related to large-scale equipment (e.g., CNC machine) (DiCarlo et al., 2022), but few studies examined the integration of AI for the purpose of learning in makerspaces or maker programming. Of course, despite the promise of LLMs, there is a significant gap in research and practice regarding their effective and ethical use in library makerspaces and maker programming, especially for children. Integrating GenAI into children's programming has challenges, including managing cognitive load, addressing ethical considerations, and mitigating potential biases in AI-generated content (Bender et al., 2021). Therefore, this planning grant project could contribute to finding any needs, challenges, and potential strategies for using GenAI to better support library professionals in providing quality services and programming for children.

Report of our Pilot/Feasibility Study for this Project

What we have done:

In preparation for this project, PIs Liu and Jung have already worked on a pilot study, in which we ran a one-time program (1-1.5 hours) for children's STEM learning with ChatGPT (as an example of a widely used LLM-enabled GenAI chatbot) at several public libraries. By collaborating with library professionals in three urban/suburban library branches (e.g., [Pioneer Library System](#), see their letter of support) in Norman and Oklahoma City, we were able to offer the program six times from November 2024 to February 2025. This pilot program was targeted at children (6-12 years old) and their caregivers (e.g., parents); library professionals were mainly in charge of promoting the program and preparing classroom setups while our research team developed the curriculum and taught the program as the lead facilitators. This pilot program was designed based on PI's previous experiences with children's programming related to STEM, data literacy, and makerspaces (Jung, 2023; Jung & Liu, 2022, 2024; Jung et al., 2024). The following activities were included: (a) children and their caregivers were briefly introduced to how to use ChatGPT, (b) they used ChatGPT to figure out what Squishy Circuits (a circuitry STEM toolkit with LED lightbulbs that could be connected to clays to make creative circuits) are and how to create clay-based creative circuits, and (c) they briefly discussed their experiences and what they had learned at the end of the session. Throughout the activities, they were asked to try ChatGPT first when they had some questions or challenges in their making before asking the facilitators. (Note that our pilot study was conducted upon IRB approval at the University of Oklahoma. IRB#: 17826)

What we have achieved:

This pilot study led us to build **initial partnerships** with the participating libraries, which can serve as the basis for expanding our experiments across different states and regions under the support of this planning grant. Also, from these partnering libraries, we confirmed the **potential interest of public libraries** in this type of programming on creative approaches to AI literacy and STEM learning. We received **positive feedback from children** and their caregivers as well that they would be interested in engaging more with similar kinds of learning opportunities related to STEM and/or AI literacy. Thus, our pilot program could be **the basis for developing more refined programs** and learning activities for AI literacy through maker-based learning.

Lessons learned & Questions left:

- (1) **Expanding partnerships:** While we appreciate that we made initial partnerships with some public libraries, we acknowledge that these partnering libraries were all located in urban/suburban settings, closer to the university where PIs work. With this planning grant, we hope to expand our partnerships by including more libraries beyond the area, especially rural and smaller libraries that may need more resources and help in programming.
- (2) **Understanding the needs of public libraries nationwide:** What we learned from the libraries we had worked with was helpful in finding the potential of public libraries' interest in STEM and AI literacy programming. Based on that, we found the need for nationwide data about how public libraries across the states perceive the necessity of STEM and AI literacy programming, what resources they currently have, and what support they need.
- (3) **Designing a curriculum and specific scaffoldings for children and caregivers:** During the sessions from the pilot study, we observed that children, especially those who are new to AI and/or maker technology, might need more structured scaffolding to figure out what questions they should ask in order to get the information they want, which

would be directly related to critical thinking and problem solving that are key in both STEM learning and AI literacy. We also observed that it might be more challenging for younger children or older caregivers (e.g., grandparents) who might not feel comfortable using a computer to type and search for information. Thus, we hope to develop a more refined curriculum with more activities promoting discussions on AI literacy using various types of STEM maker technologies and GenAI tools.

(4) Developing staff training: In the pilot study, PI Jung mainly led the sessions as the lead instructor while having the library staff as assistants, but they all were interested in learning more about maker tools and AI, developing STEM and AI literacy programs for children and families, and leading the programs. Their interests made us reconfirm the importance of training materials and support for library professionals.

Project Work Plan

This project consists of three sequential phases, each designed to systematically investigate the feasibility, pedagogical value, and ethical implications of integrating GenAI chat systems into maker-based STEM learning in public libraries. The work plan follows a structured approach that includes empirical research, participatory design, and pilot implementation, while maintaining an iterative feedback loop with library professionals, children, and advisory board members to ensure real-world applicability, ethical AI engagement, and pedagogical effectiveness. Each phase is designed to build on the findings of the previous phase, allowing for adjustments and refinements based on empirical evidence and stakeholder input.

Phase 1: Needs Assessment and Partnership (Months 1-8)

(A) Investigate feasibility, needs, and challenges (through survey, interviews, and literature review):

The first phase of the project will systematically investigate the feasibility and challenges of integrating LLM-enabled GenAI chat systems into children's maker-based learning in public libraries. The research will focus on instructional gaps, AI literacy, ethical concerns, and practical considerations for implementation. By engaging key stakeholders—including library professionals, children, and caregivers—this phase will generate evidence to inform the curriculum design process (in Phase 2) and the implementation and assessment (in Phase 3). A mixed-methods approach will be used, combining semi-structured interviews, a national survey, and a literature and policy review.

First, **a broader nationwide survey** will be distributed to library professionals and caregivers to capture broader trends in AI literacy, adoption barriers, and ethical concerns. The survey will include validated AI literacy assessment instruments along with customized questions designed to measure perceived feasibility and willingness to integrate AI tools in maker-based learning programs. It will be disseminated through library associations, state library networks, and targeted online communities where library professionals and caregivers engage in discussions about education technology. Advisory board members will assist with survey distribution to maximize reach across different library types and geographic regions. The survey data will be analyzed using descriptive and inferential statistics to identify key factors that influence AI adoption in library programming.

Additionally, **a literature and policy review** will synthesize existing AI literacy frameworks, best practices for ethical AI integration, and public library policies related to emerging technologies. The review will examine relevant educational guidelines on child-AI interactions and analyze existing safeguards for mitigating risks such as misinformation and privacy violations. This component will provide a foundation for designing AI safety measures that can be tested in later phases of the project.

Also, **interviews with library professionals** from urban, suburban, rural, and tribal libraries will explore how they facilitate maker-based learning, their experiences with supporting diverse learners, and their perspectives on AI as an instructional tool. Recruitment will be conducted through professional library networks, outreach to libraries with active maker programs, and the advisory board's recommendations. 30 library professionals will be selected to capture diverse organizational structures, resource availability, and technological capacities. The interviews will examine how library staff perceive AI's potential to enhance STEM learning, their concerns about AI-generated misinformation, and the specific challenges they anticipate when supervising AI-assisted maker-based learning programs. The analysis will involve thematic coding to identify patterns across different library settings and generate actionable insights.

In addition to library professionals, the team will conduct **interviews with children (ages 6-12) and their caregivers**

who regularly participate in library maker-based learning activities. Around 10 families will be recruited through partner libraries that have active maker programs, with parental consent and child assent required under IRB's guidance. The interviews will explore their experiences with maker-based STEM learning, how they troubleshoot problems, and whether they currently interact with AI tools in educational settings. A key focus will be their ability to critically evaluate AI-generated content, recognize bias, and use AI to support creative problem-solving. Parental perspectives will also be examined through the interviews, especially about parental attitudes toward AI-assisted learning, concerns about privacy and security, and expectations for how libraries should introduce AI literacy. Responses will be analyzed through a cognitive-developmental lens to assess how different age groups engage with AI and what kinds of support they may need to develop AI literacy. Findings will inform the design of guidance materials that address parental concerns while supporting AI integration in library settings.

(B) Build and extend partnerships with public libraries:

In parallel with the data collection above, the team will reach out to public libraries from urban, suburban, and rural areas to seek two to three partnering libraries that could work with us in Phases 2 and 3 for implementing a curriculum as part of their library programming. We aim to partner with at least 7 public libraries (2 libraries for Phase 2, and 5 libraries for Phase 3), potentially including the libraries that worked with us for the pilot study. Library selection will account for variations in geographic location, community demographics, and available resources, generating findings that reflect a broad range of learning environments. Selection criteria will prioritize libraries that serve diverse populations, including those with limited access to specialized STEM instruction, in order to examine AI's potential role in addressing disparities in maker-based learning opportunities. The advisory board members (from varied backgrounds and regions, as demonstrated below) will also suggest potential partnering libraries for the team.

Expected Outcome from Phase 1:

Throughout this phase, regular consultations with advisory board members will help refine research instruments and interpret findings in ways that align with real-world library challenges. The evaluation of Phase 1 will involve qualitative thematic analysis of interview data, statistical modeling of survey responses, and comparisons with established AI literacy benchmarks. This process will identify instructional and technical gaps, inform strategies for AI integration, and highlight ethical considerations that need to be addressed before AI tools can be effectively implemented in public library makerspaces. The findings will provide a clear framework for the participatory design and prototype development work that follows in Phase 2.

Phase 2: Development of an AI-Integrated Maker-Based STEM Curriculum and Library Professional Training (Months 9-14)

(A) Develop initial program curriculum:

The objective of this phase is to develop a refined curriculum for children's STEM learning and AI literacy by assessing the extent to which AI-assisted learning influences children's problem-solving strategies, engagement, and AI literacy while also evaluating library professionals' perspectives on the feasibility and ethical implications of integrating AI into informal STEM education. Building on the findings from Phase 1 as well as our pilot study, we will develop a children's program that incorporates existing GenAI chatbots (e.g., ChatGPT, Microsoft Copilot, Llama, and Gemini) into maker-based STEM learning activities (using circuitry kits or science experiments) in public libraries. (We clearly note here that this project is *not* to develop a new AI system or agent, but rather, we will investigate how currently available GenAI systems can be adapted and structured for meaningful learning experiences in public libraries and connected to a learner-friendly interface.) The PIs and GRA will first draft the curriculum, including the duration of each session, specific activities, tasks, and timeline, maker tools and projects, and prompts of questions for scaffolding children to ask GenAI. The prompts of questions would include possible questions that children could ask GenAI, for example, when figuring out how to use a certain toolkit or when brainstorming ideas for making. This curriculum will be reviewed by the advisory board and updated based on their feedback.

(B) Experimental study to aggregate children's feedback and update the curriculum:

Then, we will share the curriculum developed by the research team and advisory board with at least two partnering libraries that have established maker-based programming and are interested in exploring AI-enhanced learning tools (recruited from Phase 1); with these libraries, an experimental study will take place. Participants will include around

20 children in total (from 2 sessions for each of the two libraries; 5 families for each session) who regularly engage in maker programs at participating libraries. Recruitment will be conducted through library programming announcements, direct invitations facilitated by library staff, and parent information sessions. Informed parental consent and child assent will be obtained before participation. Efforts will be made to include children with varying levels of prior experience in STEM and AI engagement to capture a wide range of learning behaviors and challenges. The study will use a **between-subjects experimental design**, where participants will be randomly assigned to one of two conditions. In the **AI-assisted condition**, children will work on maker-based projects such as coding, robotics, and circuitry while using GenAI (e.g., ChatGPT) through a customized interface that structures interactions to provide guidance, generate creative prompts, and facilitate troubleshooting. Our interface will incorporate embedded prompts that encourage children to reflect on AI-generated responses, recognize potential biases, and evaluate the reliability of the information provided; PI Liu has already built bias-aware user models to characterize individuals' search and learning behavior and proposed a human-centered approach to enhancing intelligent recommendations under expert supervision (Liu, 2023a, 2023b; Wang & Liu, 2023). In the **control condition**, children and caregivers will complete the same maker projects but will rely on traditional support resources, such as printed guides, instructional videos, and assistance from library staff when available. The experimental design allows for a direct comparison of how AI assistance affects children's ability to solve problems, engage with STEM content, and develop AI literacy skills through maker-based learning activities and chat interaction processes.

Data collection will involve multiple methods to analyze the impact of AI-assisted learning on children's engagement and learning outcomes. **Pre- and post-session questionnaires** will assess changes in children's confidence and experience in STEM learning, their understanding and trust of AI, and their ability to critically evaluate and utilize AI-generated content. **Task completion assessments** will compare problem-solving efficiency and creative exploration between the AI-assisted and control groups, examining whether access to AI-generated support influences the strategies children use to overcome technical challenges. **Interaction logs from the AI system** will provide insight into the types of questions children ask, how they engage with AI responses, and whether they exhibit behaviors indicative of critical engagement with AI-generated information. Trained researchers will conduct direct **observations** during maker activities, documenting behavioral patterns related to how children integrate AI support into their learning process, how frequently they challenge AI-generated responses, and how they navigate problem-solving with or without AI assistance. We will also have brief **post-session debriefs** with participating families to collect their insights from their experiences using AI during the program, including their perceptions of AI's helpfulness, limitations, potential risks, and any suggestions and ideas for refining the program.

(C) Experiment to gather library professionals' feedback and develop guides:

In parallel with testing the curriculum with children participants, we will also **invite library professionals to participate in the same program** to the AI-assisted condition of our curriculum and explore how ChatGPT as a chatbot tool could support their instructional roles in dynamic maker-based learning activities. 5 to 10 library professionals from participating libraries will be recruited and engaged in structured discussions before and after testing the AI-assisted learning system, sharing their perspectives on its usefulness, challenges, and ethical concerns. These discussions will inform an evidence-based evaluation of how library professionals perceive AI's role in informal learning environments and what types of training and resources they consider necessary for responsible AI integration. Pre- and post-assessments will also measure changes in their understanding of AI, their confidence in integrating AI tools into informal learning settings, and their concerns about misinformation, privacy, and child safety. The potential applications of GenAI chatbots and concerns shared by library professionals will be included in the curriculum design. Also, based on the insights from these library professionals, we will draft **guides for library professionals** to run the developed program (i.e., maker-based STEM learning with GenAI).

Expected Outcome from Phase 2:

Findings from this phase will lead us to update our curriculum and refine the program as well as guide the development of training materials for library professionals. These materials will provide guidance on using AI as a learning support tool while maintaining human-centered facilitation in a maker-based learning program, helping children critically evaluate AI-generated content, and addressing ethical considerations related to bias, misinformation, and privacy. The team will develop training resources, such as digital guides, in multiple formats to allow for

adaptation across different library contexts. Throughout this phase, advisory board members and participating library professionals will provide **iterative feedback** on the study design and training content, helping to refine best practices for AI-supported maker learning. The findings will inform refinements to the AI integration model before broader pilot implementation in Phase 3.

Phase 3: Curriculum Implementation & Impact Evaluation (Months 15-24)

(A) Broader implementation:

This phase builds upon the findings from Phase 2 and moves toward a broader implementation of our AI-assisted maker-based learning program in public libraries. The objective is to assess the real-world feasibility, effectiveness, and ethical considerations of integrating AI-powered learning assistants into public library makerspaces. The program iteratively developed from previous phases will be deployed across five public libraries, testing its impact on children's engagement and AI literacy in an authentic, library-facilitated learning environment. **Participating libraries will be recruited** and selected based on their prior involvement in maker-based programming, their interest in AI-enhanced education, their capacity to conduct structured learning sessions with children and caregivers, and the variety of geographical locations. Then, the research team will offer **training for library professionals** from participating libraries who would mainly lead and facilitate the sessions by utilizing the guides and materials developed in Phase 2. Then, **these library professionals will implement the program**, serving as lead facilitators, with a target sample of 50 children aged 6-12 (2 sessions for each of the five libraries; 5 families for each session).

(B) Data collection and evaluation:

This phase will adopt a longitudinal mixed-methods approach to evaluate the impact of AI-assisted maker learning. Pre- and post-program assessments will measure changes in children's STEM knowledge, AI literacy, and confidence in using AI as a problem-solving tool. AI interaction logs will be analyzed to identify usage patterns, engagement levels, and whether children critically assess AI-generated responses. Additional feedback will be collected from caregivers to assess their perceptions of AI integration in library learning and whether they see value in AI-assisted education for their children. Observations by trained researchers will document how children navigate learning challenges with and without AI assistance, how frequently they rely on AI, how the interactions with AI could facilitate their interactions with caregivers or other children, and whether they develop independent problem-solving strategies over time.

Also, we will evaluate how library professionals facilitated the programs, how they integrate GenAI tools into their instructional practices, and how well the training materials developed in Phase 2 prepare them for AI-assisted facilitation. Library professionals will provide structured reflections on their experiences using AI in maker programming, capturing insights into how AI tools support or hinder facilitation, what challenges arise in real-world deployment, and what adjustments may be needed to optimize AI integration for diverse learner needs. Further, to evaluate the effectiveness and scalability of the AI literacy training materials, library professionals will complete post-program assessments and follow-up interviews to reflect on how well the training prepared them for supervising AI-assisted learning. They will be asked to identify areas where additional training or resources may be necessary to improve AI literacy education in public libraries.

(C) Iterative refinement of the program and training materials:

The findings from this phase will inform revisions to the curriculum and the training materials, making them more adaptable for libraries of different sizes and technological capacities. A key focus of this phase will be addressing ethical considerations, privacy concerns, and responsible AI use in real-world library settings.

Expected outcome from Phase 3:

Findings from this phase will contribute to the development of best practices and policy recommendations for AI chatbot integration in public libraries, which will be disseminated through an evaluation report, open-access training resources, and knowledge-sharing sessions with library networks, professional library associations, higher education programs for library professionals (i.e., programs for master of information and library studies), and other informal educators. The results will provide practical insights for scaling AI-supported maker learning programs beyond the pilot libraries, informing future AI literacy initiatives in public libraries nationwide. By examining both the opportunities and challenges of AI-assisted learning in diverse library settings, this phase will establish a data-driven framework for responsible and effective AI adoption in informal STEM education.

Plans for Protect Participant Privacy

The project team will implement a privacy protection strategy to safeguard children participating in the study and using the system in future maker-based learning activities. No personally identifiable information will be collected during AI interactions, and all AI system logs will be anonymized before analysis. The customized interface (developed by PI Liu, mentioned above) will operate within a **closed, monitored environment**, preventing children from engaging in unrestricted open-ended conversations with the chatbot. Data collected from AI interactions will be stored on secure servers, and only aggregated, de-identified results will be used in analysis and reporting. Library professionals and caregivers will receive clear guidance on how AI will be used in the study, including transparency about potential limitations of LLM-generated responses. Additionally, children will be instructed on safe AI interaction practices, reinforcing the importance of **not sharing personal information with AI systems**. The research team will follow all IRB guidelines, adhering to ethical standards for conducting research with minors in educational settings.

Project Team

The project will be managed by PI Dr. Jiqun Liu (who specializes in **AI chatbot and information retrieval research**), co-PI Dr. Yong Ju Jung (who specializes in **maker-based learning and informal education**), and a Graduate Research Assistant (GRA). PIs have done previous projects related to AI and maker-based learning, showing their competence that will fit well with this project. For example, PI Liu has already made reasonable advancements in user modeling, human-chatbot interaction, and AI-assisted informal learning (Liu, 2023a; Liu, 2023b; Wang & Liu, 2023; Wang et al., 2024). Also, co-PI Jung has extensively partnered with libraries, museums, and makerspaces for her projects such as characterizing children's data literacy through exploring and making at a library makerspace (Jung, 2023), library makerspaces' transitions and integrations into online programs (Kim et al., 2023), and children and caregivers' epistemic agency shifts during maker activities at a museum-based makerspace (Jung et al., 2022). Furthermore, PI Liu and co-PI Jung have worked together on a previous project about children's (aged 8-12) algorithm literacy by collaborating on a library makerspace located in a suburban area in Oklahoma and analyzed how children made sense with algorithms in creative, playful ways with drawing, making, and walking around (Jung et al., 2024; Jung & Liu, 2022, 2024). The PI and co-PI also received the Elfreda Chatman Research Award from ASIS&T 2024 SIG USE for their collaborative project on children's learning in makerspace and AI literacy, which serves as a solid empirical basis for this proposed IMLS planning project and the potential national implementation following it. Building upon our previous scholarship, particularly with PI Liu's expertise in human-AI interaction research and user study methodologies and co-PI Jung's expertise in informal learning and research-practice partnerships, this proposed project will be systematically conducted by the team.

Advisory Board

Additionally, the project team includes an advisory board. Our advisory board will consist of five experts with a range of expertise, including library professionals and academic scholars: Caroline Flory, Senior Librarian/Manager in **Maker and STEAM services** in an urban library, having extensive experiences related to makerspace and STEM/STEAM programming (Durham County Main Library, NC); Wendy Burnett, **librarian representing small and rural libraries**, with valuable insights about opportunities and challenges of a smaller library (Mable C. Fry Public Library, Yukon, OK); Dr. Hyewon Park, **digital literacy instructor** & researcher at a non-profit organization offering community educational programs (Community Tech Network, CA); Dr. Soo Hyeon Kim, assistant professor specializing in research on **makerspace and family STEAM learning in libraries** (Indiana University Indianapolis, Indianapolis, IN); Dr. Jiangen He, assistant professor specializing in **human-AI interactions, LLM-enabled systems and ethics** (University of Tennessee Knoxville, Knoxville, TN). The advisory board will support the project by providing feedback on our survey and interview questions, offering comments and suggestions for a curriculum, helping recruit participating libraries, and reviewing research findings. Further, the advisory board will ensure that the project remains aligned with its objectives adheres to ethical guidelines, and evaluate the project's progress throughout three phases. The team and the advisory board meeting will regularly have meetings (3-4 times per year).

Project Results

Throughout the three phases, the expected outcomes of this planning-grant project include the following: (1) Needs and feasibility assessment; (2) Maker-based STEM and AI learning program curriculum for public libraries; (3) Training materials for library professionals; (4) Established partnerships with public libraries.

(1) Needs and feasibility assessment

Based on the survey and interview data from Phase 1, this project will document a comprehensive report that identifies the needs, opportunities, and barriers to integrating GenAI chatbot into maker-based STEM programming in public libraries. We seek to generate a range of deliverables that address the critical challenges identified in the needs assessment phase while advancing AI-assisted maker-based STEM learning in public libraries. The primary results include a needs and feasibility report, an AI-integrated maker-based learning curriculum, preliminary training materials for library professionals, an evaluation report with best practices, and a long-term dissemination strategy for scaling the project's impact. These results will support public libraries in integrating AI-assisted learning, enhance AI literacy among children, and provide structured training for library professionals, ensuring that they can confidently facilitate AI-supported maker-based education. The project directly responds to the problem identified in Phase 1, where library professionals reported a lack of AI training and concerns about ethical AI use in maker-based learning, while children demonstrated varying levels of AI literacy and ability to critically assess AI-generated content. By addressing these gaps through structured experimentation, curriculum development, and professional training, this project will contribute practical, scalable solutions that can be adopted by a broad range of public libraries.

A key deliverable will be a needs and feasibility report synthesizing the findings from Phase 1. This report will document the major barriers and opportunities associated with AI integration in library makerspaces and record insights from library professionals, children, and caregivers about the perceived benefits and risks of using AI in informal learning environments. It will provide concrete recommendations for libraries considering AI-assisted programming, including guidance on instructional strategies, ethical considerations, privacy concerns, and necessary safeguards against misinformation. The report will be made publicly available to help libraries, educators, and policymakers make informed decisions about AI adoption in informal learning settings. By providing actionable, evidence-based insights, the report will serve as a critical resource for libraries seeking to navigate AI adoption responsibly and will lay the foundation for the development of AI literacy training materials tailored for public libraries.

(2) Maker-based STEM and AI learning program curriculum for public libraries

This project will produce a program curriculum of maker-based STEM learning with GenAI Chatbot, which could be implemented in public libraries. Throughout Phase 2 and Phase 3, the project will develop a curriculum by embracing research team members' expertise, library professionals' recommendations, and patrons' (children and their caregivers) feedback. The program will be designed to facilitate critical thinking, problem-solving, and STEM engagement through AI-assisted learning. This curriculum will incorporate structured AI literacy instruction, providing children with the necessary skills to critically evaluate AI-generated content, recognize biases, and make informed decisions about using AI in problem-solving. The curriculum will include a series of hands-on maker-based activities where AI serves as a learning assistant rather than a replacement for human instruction, allowing children to test AI suggestions, refine their ideas, and develop independent problem-solving skills. Unlike existing AI literacy programs that primarily focus on coding, this curriculum will emphasize practical AI literacy in real-world problem-solving contexts and will be adaptable for use across different types of libraries, including those with varying levels of technological infrastructure. The flexibility of the curriculum will allow libraries to modify activities based on available resources and the needs of their specific communities, ensuring that it is broadly applicable across different library environments. Another major outcome will be a set of structured training materials for library professionals, equipping them with the necessary skills and knowledge to facilitate AI-assisted learning in makerspaces. These materials will be developed based on findings from Phases 1 and 2 and will provide practical guidance on integrating AI tools into informal learning settings, teaching children how to critically assess AI-generated responses, mitigating the risks of misinformation, and addressing ethical concerns such as bias and privacy. The training will include interactive modules, instructional videos, and case-based learning scenarios, allowing library professionals to engage with AI literacy concepts in ways that are directly relevant to their work. These resources will be designed to accommodate varying levels of AI familiarity, ensuring that both experienced and novice library staff can benefit. By providing structured training materials, the project will help libraries develop internal capacity to sustain AI-integrated maker-based learning programs beyond the grant period.

(3) Training materials for library professionals

Along with the program curriculum, this project will provide training materials and webinars about the curriculum and potential use of GenAI in makerspaces and maker-based programming in libraries. Such resources will be shared with the public through the project team's website and social media accounts. Also, the curriculum and training materials will be made publicly accessible through an open-access online repository, allowing libraries, educators, and policymakers nationwide to explore, adopt, and adapt resources according to their specific needs. The repository will be hosted on an established educational digital platform. The platform will be designed to support modular downloads, interactive content, and multilingual translations, making the materials more usable across diverse library settings. The repository will include downloadable curriculum guides, interactive AI literacy training modules, case studies from partner libraries, and instructional videos demonstrating how AI can support maker-based learning.

Further, to maximize the reach and impact of the project, findings and deliverables will be disseminated through multiple channels targeting both immediate stakeholders and broader audiences. To encourage widespread adoption, the project team will collaborate with library professional associations and also conduct webinar series and online workshops in collaboration with state library associations and regional library consortia, providing hands-on guidance for integrating AI-assisted learning into library programming. For example, we will offer a series of webinars for library professionals by collaborating with related groups, such as IMLS-funded [Library Makers](#) (see their letter of support) and [National Library Makerspace Forum \(LG-256680-OLS-24\)](#) as well as other professional organizations (e.g., American Library Association [ALA]). These sessions will allow library professionals to engage in interactive discussions, troubleshoot challenges, and share implementation strategies. Partner libraries will also play a crucial role in dissemination, sharing implementation experiences and testimonials through guest blog posts, case studies, and video testimonials on library association websites, extending outreach beyond traditional conference and journal formats. Beyond direct dissemination, the project will engage with educational technology networks and AI literacy initiatives to incorporate findings into broader AI education efforts.

Also, the project team will present research findings, best practices, and implementation case studies at major national and regional library and education conferences (e.g., Association for Information Science and Technology [ASIS&T], Association for Library and Information Science Education [ALISE], American Educational Research Association [AERA]). These conferences provide a platform for engaging with both practitioners and researchers in library and information science, education, and human-computer interaction. Presentations will be tailored to different audiences, ensuring that both theoretical insights and practical recommendations are communicated effectively. The team will also submit findings to peer-reviewed journals such as *Library & Information Science Research*, *The Journal of Education for Library and Information Science*, and *Information and Learning Sciences*, alongside professional library publications like *Public Libraries Magazine* and *Children and Libraries*, ensuring that research findings are disseminated both academically and in practitioner-oriented outlets. These contributions will highlight real-world applications of AI-assisted maker-based learning, making adoption more appealing and accessible to a broader range of library professionals.

(4) Established partnership with public libraries for continued and expanded implementation of the program

Based on the support from this planning grant, we will establish partnerships with a range of public libraries from urban, suburban, and rural locations. This partnership will help extend this project to more libraries adopting the STEM maker-based learning curriculum with GenAI and plan for additional curriculums in the future. Also, to sustain the project's impact beyond the funding period, the team will build a long-term implementation strategy in collaboration with partner libraries, researchers, and advisory board members. This will include establishing a knowledge-sharing network among participating libraries, where library professionals can continue exchanging best practices and lessons learned from AI-assisted maker learning. The team will explore opportunities to integrate the curriculum and training materials into ongoing professional development programs offered by library consortia and professional organizations, ensuring that new cohorts of library professionals can continue benefiting from the resources developed through this project. Additionally, the project team will seek future funding opportunities to expand AI-integrated maker-based learning to additional libraries, building on the foundational research and implementation conducted during this planning grant period. The adaptability of the curriculum and training materials, combined with strategic dissemination and long-term partnerships, will enable this project to have a lasting impact on public library education and AI literacy efforts well beyond the grant period.

Gauging Library Needs for Integrating Generative AI into Children's Maker-Based Learning

Jiqun Liu & Yong Ju Jung

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Note:

- Phase 1 (Blue): Months 1-8 (Aug 2025-Mar 2026); Phase 2 (Green): Months 9-14 (Apr 2026-Sep 2026); Phase 3 (Orange): Months 15-24 (Oct 2026-Jul 2027)
- This is a tentative schedule of the project with estimated time duration for the tasks. The schedule could be revised and adjusted depending on the actual completion time of each task. For instance, the rounds of iterative curriculum development needed may vary depending on the feedback of community members and librarians as well as the actual performance of prototype systems; Also, the number of experimental sessions and participants may vary across public libraries with varying levels of technical support and resources.