AI & Co-design in public libraries: Empowering underserved youth to cultivate symbiotic relationships between Artificial Intelligence (AI) and their communities

1 Project Summary

Artificial Intelligence (AI) is ubiquitous. The consequences of AI's ubiquity can be both positive (e.g., AI dynamically controls traffic lights to enhance city traffic (Chui et al., 2018)) and negative (e.g., AI replacing human workers (Acemoglu and Restrepo, 2017)). Economically underserved communities, in particular, are vulnerable to AI's negative consequences as they are largely excluded from the decision-making process of envisioning AI technologies in society. Michigan State University (MSU) and Indiana University (IU), in partnership with the Young Adult Library Services Association (YALSA), the Capital Area District Library (CADL) in Lansing, Michigan, the San Diego Central Library (SDL) in San Diego, California, and the Carroll County Public Library (CCPL) in New Windsor, Maryland, request $249,999 for a two-year National Leadership Project Grant to develop an AI literacy program for youth in underserved communities. As an exploratory project, we will examine the role of the library as a community catalyst to enable economically underserved youth to 1) have access to core knowledge about AI, and 2) play an active role in designing AI technologies for their communities. This project follows a pedagogy built upon a critical race theory that views students from socially underserved communities not as people with deficits but as people with *"community cultural wealth"* (Yosso, 2005). By using *participatory design* methodology, 10-14 year old students in this project will utilize their own assets to co-design AI technologies for their community. Our project will generate publicly available open-source AI education modules and webinars to support public libraries to run their own AI literacy programs. Through our partnership with YALSA, our materials will be disseminated to many youth librarians across the country. If the pandemic continues, our research will be performed online.

2 Statement of National Need

Since 2015, the United Nations (UN) has organized an annual global summit to evaluate the impact of AI on society (UN, 2020). While AI influences many people, only a relatively small population of engineers determine how the public interacts with AI in everyday life (Baumer, 2017). The public's limited access to AI knowledge stems from the fact that it is mostly disseminated by higher education programs. In particular, these programs mostly focus on computational aspects of AI rather than on social and ethical aspects. This reinforces a digital divide and inequity issues at a national level (Acemoglu and Restrepo, 2017; Huang and Rust, 2018). Thus, **it is imperative to run AI literacy programs through sustainable infrastructures where community members, regardless of their socioeconomic backgrounds, have access to AI knowledge.**

Since the internet emerged in the mid-1990s, public libraries, as early adopters, have long played a critical role in enhancing technology literacy in the US (Bertot et al., 2008; Ito et al., 2013; Braun and Visser, 2017). As we enter an era of increased AI technology in our society, libraries have tremendous potential for nurturing AI literacy. Building on the role of public libraries as facilitators of digital literacy (Ito et al., 2013; Subramaniam et al., 2012), the goal of this project is to explore how library-based AI literacy programs can serve underserved youth communities.

Need 1: Broaden participation in AI through a library-based STEM program.

The AI development community lacks diversity and diverse perspectives. Since its inception, bias has existed in the decisions behind the types of knowledge deemed as important for translating into AI technologies (Ensmenger, 2012; Adam, 2006). The epistemological culture of AI is largely formed by people who are middle class and male (Adam, 2006). These groups' values and biases are in turn reflected in AI. As a consequence, for example, facial detection AI is less accurate in correctly detecting the faces of women and people of color (Raji and Buolamwini, 2019). Thus, a lack of involvement in the design process has broad negative consequences for diverse users.

Considering the fast-growing influence of AI on society, various AI education programs for kids and K-12 students have recently been developed (e.g., AI for K-12, AI4ALL, Machine learning for kids, AI for Oceans by

code.org). However, they rarely address the issues of diversity and inclusion within AI education. One group of these programs are designed as public school programs that economically vulnerable populations not in the specific school districts have limited access to (e.g., AI for K-12. Another group of AI education programs was developed as online programs (e.g., AI4ALL, Machine learning for kids, AI for Oceans by code.org), which only those who would intentionally look for AI education would have access to.

This accessibility issue needs an urgent resolution given that economically vulnerable populations would encounter future hardships as AI replaces jobs: over the next ten years, two million jobs, in manufacturing alone, are predicted to be replaced by AI and robotic technologies (Acemoglu and Restrepo, 2017). Many of those currently holding these jobs lack a college degree and are already economically underserved. Economically underserved communities – especially youth – must develop AI literacy to prepare for the challenges associated with this rapidly changing work environment.

Libraries are the best medium to tackle this accessibility issue. Public libraries have already provided infrastructure and experience in delivering STEM education to various local communities over decades. To continue this effort, we are making one of the first attempts to build a library-based AI education program for youth, increasing the public's accessibility to AI knowledge. In particular, we adopt a *participatory design* methodology within which youth become co-designers of AI systems. This project provides resources for librarians to utilize co-design practices to empower youth in their communities, which has been discussed as an innovative approach for STEM education in previous IMLS projects (e.g., LG-96-18-0041-18, LG-14-19-0079-19).

Need 2: Cultivate civic engagement of underserved youth within their local communities.
Libraries have been at the center of communities as a community catalyst and enhance community members' civic engagement (e.g., LG-94-18-0278-18, RE-246317-OLS-20). Building on this continued effort, our AI education programs are designed to inspire youth to envision how AI could benefit their local communities.

The existing AI education programs mainly focus on delivering core AI knowledge to students, such as how to build a classifier and how biased data could generate a model reflecting stereotyped views (e.g., job applicant screening algorithm excluding racial minorities and women applicants). Although existing education programs provide examples showing the influence of AI on society, they are not closely connected to the issues from a community where students reside.

Unlike previous AI education programs, we will not only teach students core AI concepts, but also help them more actively *engage with local civic issues* as co-designers. For example, we will introduce local media stories about AI in their communities and discuss how technological issues are closely entangled with social issues. Our program will develop critical thinking capabilities, enabling youth to understand AI-related social issues in their communities and actively participate in public discourse about AI technologies.

Need 3: Develop an asset-based STEM education program for underserved youth.
Libraries have successfully provided informal STEM education programs for economically underserved youth such as Connected Learning (Ito et al., 2013), Ready-to-Code (Braun and Visser, 2017), and other library programs funded by IMLS (e.g., LG-95-18-0024-18, lg-95-18-0025-18, LG-14-19-0079-19, re-246317-ols-20, RE-246380-OLS-20). Building on existing efforts, our proposal focuses on an *asset-based approach* for library STEM education programs.

Students from underserved communities are often considered as people with limited cultural, social, and economic capital (Bourdieu and Passeron, 1990). Thus, in education settings, these students are considered as empty vessels and their education often focuses on how to compensate these deficits (Freire, 1968; Yosso, 2005). However, this need-based model of education to fix the deficits does not provide opportunities for these students to recognize or to utilize their own assets. Building on critical racial theory, Yosso created a new education model of *"community cultural wealth"* that challenges stereotyped views on students as people with problems but as people with their own assets (Yosso, 2005). In contrast to the conventional capital (e.g., income), the community cultural wealth model indicates different types of assets including aspirational capital (e.g., resiliency to maintain dreams for the future regardless of various barriers) and familial capital (e.g., maintaining caring relationships

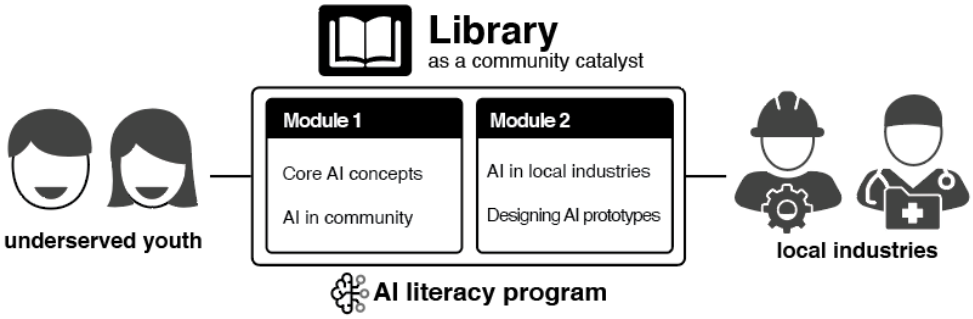


Figure 1: Library as a community catalyst increases AI literacy of underserved youth and enables them to envision how AI can benefit local industries including manufacturing and healthcare industries.

among the members of kinship, religious groups or other types of social community).

As a first step of our education program, students will be asked to think about their own assets (e.g., experiences of overcoming their difficulties) and share them. This process will help students see themselves as people with their own knowledge and position them as people who can utilize this knowledge. This will also help them more easily become co-designers in our participatory design sessions. We will also discuss how these assets of underserved youth can enhance AI technologies. For example, we will discuss how the "caring relationship (de La Bellacasa, 2011)" of familial capital can contribute to developing symbiotic relationships between AI systems and human workers. With caring relationships, AI can view human workers as community members rather than simply a replaceable labor resource.

Alignment with IMLS project category

This project is under the category of "community catalysts" as the proposed AI education program invites economically underserved youth as active members of their local communities to co-design AI technologies. Rather than just teaching AI-relevant skills, the proposed program focuses on enabling youth in the community to develop competency in the core concepts of AI, apply them to their own community issues, and envision how AI can be used in local industries (see **Figure 1**). We will therefore use participatory design methodology that addresses the importance of empowering socially marginalized groups as active collaborators within the design process of new technology (Lee et al., 2017a; Lee and Riek, 2018; Moharana et al., 2019; Robertson and Simonsen, 2012). This participatory methodology has been successfully used to support libraries as community catalysts in IMLS-funded projects (RE-12-19-0094-19, RE-17-19-0036-19, RE-18-19-0072-19, LG-81-16-0151-16, and LG-96-18-0041-18). Two of the PIs from the last two projects are our advisory board members (AB) (see **Section 3**).

3 Project Design

We will conduct the proposed project activities as a cohesive team of participating experts. Roles will be defined based on expertise and experience as follows:

The main research team consists of Dr. Hee Rin Lee (PI), Dr. Kahyun Choi (co-PI), Dr. Soo Hyeon Kim (Research scientist), and graduate assistants from MSU and IU. *Dr. Hee Rin Lee* is a pioneer and an expert in participatory design research in robotics with 10 years of experience on this topic (Lee et al., 2012; Lee and Šabanović, 2013; Lee et al., 2016, 2017a; Lee and Riek, 2018; Lee et al., 2017b; Moharana et al., 2019; Taylor et al., 2019)). *Dr. Kahyun Choi* is an expert in machine learning for music digital libraries ((Lee et al., 2013; Hu et al., 2014; Downie et al., 2014; Choi et al., 2014, 2015, 2016; Hu et al., 2017; Choi et al., 2018; Choi and Stephen Downie, 2019; Choi, 2021)). She will bring her experience of developing and teaching an introductory and intuitive machine learning course. Both PIs will manage all activities with other research team members, library partners, AB members, YALSA, and participants. *Dr. Soo Hyeon Kim* is a youth informal STEM education expert who led the STEM Pillars project, MG-77-16-0137-16 (Zimmerman et al., 2015; Land et al., 2017;

Kim and Zimmerman, 2017a,b; Zimmerman et al., 2019; Kim and Zimmerman, 2019; Jung et al., 2020; Kim and Zimmerman, 2020; Kim and Copeland, 2020; Kim et al., 2020; Maltese and Simpson, 2021; Kim and Soo Hyeon, 2021; Kim and Copeland, 2021; Kim and Kim, 2021; Kim and Zimmerman, 2021). As an external evaluator, she will provide a formative evaluation of our materials to help examine how the project goal can be achieved through the proposed education materials. Graduate assistants will assist PIs in various project activities, such as collecting and analyzing data and developing and managing the project website.

The participating librarians from three partner libraries have led multiple youth STEM programs including Code Clubs, virtual reality programs, robot education programs, digital design/fabrication programs. The Capital Area District Library (CADL) team includes Jill Abood (Community Engagement Specialist) and Courtney Tang (Digital Services Specialist); the Carroll County Public Library (CCPL) team consists of Bob Kuntz (Director of Operations and Innovation), Jen Bishop (Emerging and Digital Technologies Manager), and the Experience Design Specialists at Exploration Commons' Makerspace (Karen Daniel, Ben Horvat, Jon Jopse, and Amanda Krumrine); from the San Diego Central Library (SDL), a youth librarian (Vanessa Gempis) and a digital technology manager (Catherine Hoang) will join. Three local industry partners - manufacturing (Lansing, MI), healthcare (San Diego, CA), and public safety (New Windsor, MD) have also confirmed their commitment (See Supporting Document 2 & 3 for the letters of support from the libraries and the industry partners).

YALSA as a partner will publicize our open-source education materials developed within this project to librarians all over the US. These materials will include a detailed process of how we develop our program and how we run it including a summary of each session, main takeaways, lessons learned, and suggestions for future literacy programs. YALSA will also help us develop AI literacy webinars for librarians (institute), promote the program, and perform other marketing activities via their outlets, such as social media, weekly news letter, e-blast and other platforms. (See Supporting Document 2 for the letters of support from YALSA)

The advisory board (AB) consists of an expert on STEM education in libraries (Dr. Kyungwon Koh from University of Illinois Urbana-Champaign), experts on co-design in libraries (Dr. Jason Yip and Dr. Jin Ha Lee from University of Washington), an expert on AI education (Dr. Hye Won Park from MIT), and an expert on a STEM curriculum development (Dr. Joseph Krajcik from MSU). The AB has ample experience with IMLS projects including RE-07-14-0048-14, LG-81-16-0151, LG-96-18-0041, LG-246251-OLS-20. We will conduct virtual meetings with AB members two times per year to obtain their feedback on project activities including the development of data collection instruments and development of resources and will engage their specific expertise in the project activities as indicated above. (See Supporting Document 4 for the letters of support from the AB)

Budget: Funds are requested for: 1) salary and fringe benefits support for the PIs during the summer; 2) support for two full-time graduate student (including tuition, stipend, benefits, and fees); 3) travel support for PIs and graduate students, 4) stipends for libraries and YALSA; and 5) participant incentives and research supplies. The total amount requested for the project is $249,999. See Budget-related forms and justification for details.

We propose four phases of research (see **Table 1** for the detailed information of data collection and outcomes):

- Understanding assets of underserved youth and how they conceptualize AI
- Developing AI literacy program and materials
- Running AI literacy programs in three libraries
- Disseminating our findings and education materials

Activities	Role of partner librarians	Data collection & deliverables
Phase 1 1. Individual interviews with participants, their parents, and teachers	1. Helping PI and co-PI recruit students, their parents, and teachers 2. Discussing interview results with the PI and co-PI to prepare next Phase	1. Qualitative data showing how participants conceptualize AI 2. Qualitative data explaining the assets of low-income youth in terms of community cultural wealth Yosso (2005) 3. **Education material 1**: Generate materials to understand underserved youth's assets as well as their ways of conceptualizing AI
Phase 2.a 1. Reviewing existing AI literacy programs for youth and analyzing pros and cons of each program 2. Discussing with librarians a feasible program outline by comparing it to existing education materials	1. Understanding existing AI education programs and platforms 2. Discussing realistic AI literacy program outlines with the PI and co-PI (e.g., choosing potential education platforms)	1. **Education material 2**: Literature review of existing education materials that provides an overview of AI literacy programs for librarians who might want to customize education materials. 2. Finalized outline of our AI education progra
Phase 2.b 1. Developing project activities based on the chosen education platform 2. Visiting/Interviewing local industries, collecting video and picture information, and interviewing professionals in the industry	1. Visiting/Interviewing local industry together with the PI and co-PI, and requesting pictures to prepare education materials for local industry related activities 2. After the PI and co-PI develop the education materials, learning the education materials and providing feedback	1. **Education material 3**: List of core AI education materials 2. **Education material 4**: Video and picture data illustrating workplaces 3. **Education material 5**: Qualitative data explaining current issues of each workplace and potential needs of AI for the issues 4. Formative evaluation from an informal STEM education expert 5. Getting feedback from AB
Phase 3 1. Running an AI literacy education program in the three libraries	1. Learning how to run the AI literacy program from the PI and co-PI 2. Running AI literacy program together with the PI and co-PI	1. Quantitative and qualitative feedback from the librarians 2. A plan for updating existing education materials to increase replicability
Phases 3 and 4 1. Exit interviews with participants, their parents, and the librarians after AI programs	1. Discussing exit interview results with the PI and co-PI 2. Suggesting how to redesign the AI literacy materials 3. Writing AI literacy program guidelines for fellow librarians	1. Qualitative evaluation data of the AI education program from the participants and parents 2. Formative evaluation from an informal STEM education expert 3. Getting feedback from AB 4. Generating webinars and other education materials for librarians that will be disseminated through YALSA 5. Publications based on the data

Table 1: Data Collection and Outcomes - The research team will analyze the collected qualitative data based on Charmaz's grounded theory (Charmaz, 2006) and Clarke's situational analysis (Clarke, 2003).

3.1 Phase 1: Understanding assets of youth and how they conceptualize AI (Summer 2021)

For a holistic understanding of current AI education, we will interview 10 middle school students through each of the three libraries. The PI, co-PI, and graduate students will conduct these interviews to understand how the participants conceptualize AI. After analyzing the interview data, the PI, co-PI, graduate students, and librarians will discuss their findings, and prepare the next phases of the project together.

- **Understanding youth participants' assets**: Based on Yosso's community cultural wealth concept (Yosso, 2005), we will ask participants if they can share experiences that are relevant to community cultural wealth (e.g., resiliency, or caring relationships with their community groups). The findings will help us incorporate the assets of the students into our education materials and ensure that the materials do not reflect a deficit view towards underserved students.
- **Understanding youth participants' current knowledge of AI**: Rather than quantitatively evaluating students' existing knowledge, we will explore how they conceptualize AI by asking them to make a "mind map" of the AI concept. The mind map is created by asking them to write any 15 words that they think are relevant to AI. The PI has previously adopted this established method in her research to understand participants' experiences using their own words (Lee et al., 2017b; Lee and Riek, 2018). This approach will enable the research team to understand what types of technologies participants relate AI to and what types of previous experiences with AI they have had. We will use the examples discussed in this phase for teaching AI concepts in our AI education program. By using a participatory approach, we will develop a foundation, based on the participants' culture and existing knowledge, onto which we plan to build new knowledge.
- **Understanding career paths of underserved youths through interviews with teachers and youth participants**: The PI, co-PI, and graduate students will interview teachers and youth participants about the career paths of underserved youths, particularly in local industries. Our team will use this information when we develop participatory design activities about local industry. For example, when we interview workers in local industries, we will choose workers within the specific specialties or who have similar career paths as those mentioned by the teachers and youth.

Based on the findings in Phase 1, we will create activity materials that ask youth participants to describe their assets and to visualize how they conceptualize AI. These activity materials will be used as a part of Module 1 (see section below).

3.2 Phase 2: Developing an AI literacy program and materials (Fall 2021 - Spring 2022)

The two main components of our program will be *1) Module 1—Understanding core concepts of AI, and 2) Module 2—Envisioning AI for local industries*. When developing the core education program, the research team (PI, co-PI, and graduate students) will review existing platforms and curricula, and share this information with the librarians. We will discuss the advantages and disadvantages of previous materials with regard to library settings and the expertise of each librarian. After planning a curriculum based on discussion among the research team and librarians, the PI and the co-PI will seek feedback from the AB. The research team will then develop curriculum and materials for this project. For local industry relevant materials, the research team and librarians will either physically or virtually visit the local industry workplaces to interview workers to understand their work and to collect photos and videos demonstrating their work. After these visits, the research team will work together to develop the program materials. When finishing curriculum development, the PI and Co-PI will have another meeting with the AB to obtain feedback. The PI has already conducted interviews and participatory design workshops that explore how AI can be used in their workplaces with manufacturing workers in Michigan and with healthcare professionals in San Diego (Taylor et al., 2019).

- **Module 1. Understanding core concepts of AI**: To explore the potential of education platforms and activities to teach core AI concepts, we will first review existing resources such as "AI Learning Curriculum for Kids

(Dale Lane, IBM, 2019)," "Teachable Machine with Google (Google, 2020a)," and "An Ethics of Artificial Intelligence Curriculum for Middle School Students" (Dr. Park, our AB member, developed this curriculum) (Media Lab, 2020). This review process will help us understand the pros and cons of each platform and curriculum. We will choose an existing platform (e.g., Google Teachable Machine (see **Figure 2**) or Scratch, a block-based programming language for children) as developing a new platform would require time and effort beyond the scope of this project. We will customize curriculum materials to work well in library settings. Additionally, we will focus on incorporating local community issues into our curriculum and encouraging the youth participants to be co-designers rather than passive learners.

When developing these modules, we will consider each library's resources (e.g., computers, makerspace, humanoid robot), previous STEM education practices (e.g., Girls Who Code Club, Code with Pepper, Weekly Code Club), and the librarian expertise while developing our curriculum. Because the three libraries differ, the PI and co-PI will help the librarians to flexibly tailor their curriculum. This process will be reported in the final materials for librarians. For example, CCPL would consider incorporating their Pepper robot as a part of their program. Pepper is a humanoid robot that CCPL owns from their previous STEM program.

By adopting a co-design approach, our education materials will deliberately include hands-on design activities that position participants as active learners and co-designers in shaping future AI technologies. For example, at the end of Module 1, students will develop their own AI prototypes using crafting materials and AI education platforms such as Google AI (see **Figure 2**).

• **Module 2. Envisioning AI for local industries**: We will prepare materials that describe how AI can be utilized in local businesses. These materials will include videos and photos of three workplaces. The PI and co-PI will visit the workplaces and collect information about the issues by interviewing workers, taking pictures, and recording videos. In Michigan, we will focus on manufacturing because of the prevalence of manufacturing industries, and thus jobs, in Michigan (and the US) (U.S. Bureau of Labor Statistics, 2020). We will work with the local healthcare industry in San Diego, CA, and the local public safety industry in Carroll County, MD. All three industries continue to actively adopt AI systems (Yao et al., 2017; Li et al., 2017; Jiang et al., 2017), creating new issues that the next generation of the workforce must be equipped to resolve.

The participants will be able to get a sense of the job tasks and work environments of these three businesses through the information we collect. For example, we will present videos of workers' interviews illustrating their workflows and issues that can be addressed by AI. This will help them envision what types of AI systems would support these environments. After developing ideas, we will share them with local industries and get their feedback, which will be passed to the participants while developing prototypes.

We will develop detailed education instructions and materials with clear guidelines on how to use them for librarians. This will include how the research team and librarians choose AI education platforms, hands-on activities, and AI related news articles. The developed materials will be reviewed by our AB. Our external evaluator will evaluate the materials to examine how our pedagogical approach based on community cultural wealth and participatory design is achieved. Based on the formative evaluation, we will update our materials.

3.3 Phase 3: Running AI literacy programs in three libraries (Summer 2022- Fall 2022)

The librarians will assist with participant recruitment based on their previous relationships with the local school districts. We will recruit 10 youths at each library. The PI, the co-PI and the librarians will co-teach the participants. We will teach the basic concepts of AI (Module 1) and discuss how AI can be applied to local industries (Module 2). We will cover both modules in four 1.5-hour courses that we will develop in Phase 2 as described above. Because the research team and librarians will develop the education materials collaboratively, everyone will be familiar with the materials and be able to flexibly take on the roles of teachers and supporting teachers. We will provide these variations in our education modules to let librarians adopt the most appropriate models.

We will run our program in CADL first. The SDL and CCPL librarians will access the program through teleconferencing to observe the teaching process. After conducting the first program at CADL, we will share our

Figure 2: A tiny sorter project made of Arduino, cardboard, googly eyes, and the Google AI education platform.The tiny sorter categorizes whether an item is a marshmallow or a piece of cereal (Google, 2020b). For this project, students first collect images of pieces of cereal and marshmallows to train an AI system. Then, they develop paper structures with googly eyes that can physically sort cereal and marshmallow and connect them to an Arduino, a microcontroller (an easy-to-use open-source electronic prototyping platform).

experience with the AB and get their feedback to prepare the next programs at SDL and CCPL. After each session, the research team and librarians will meet to develop guidelines for other librarians outside of this project.

- **Module 1. Understanding core concepts of AI:** The first step will be to discuss students' assets and how they conceptualize AI. This will be performed with the developed materials from our initial interviews. We will compare how students differently conceptualize AI during this initial stage to the stage after completing this program. Using our AI platform (either Teachable Machine platform of Google or Scratch), we will show participants how to develop a simple AI system, such as an algorithm to recognize a picture of a dog. After introducing basic concepts, participants will use the AI platform to develop their own system that is able to identify an object of their choosing. We will give participants online access to the AI platform so that they can use it at home and potentially share their learning experiences with their family.

  In the second class, we will read local news articles about AI and discuss the social aspects of the AI system. Participants will re-design their simplified version of the AI system to be more socially engaged. An example lesson may include the following: First, we will discuss a news article about a AI facial detection surveillance system in Detroit (Harmon, 2019). We will describe how facial detection AI systems work using our AI education platform. Then we will explain how the existing face database is employed to monitor people in the Detroit area. Next, we will discuss potential social issues, such as privacy issues that stem from the facial image data collected by the AI systems. As a last step, we will re-design the simplified version of the AI monitoring system to illustrate how it can be more socially-aware and avoid potential negative social consequences.

  In the third class, we will split the class into groups of 2 or 3 students to develop a group project. We will provide a few sample projects if the participants do not have a project already in mind. Sample projects include 1) a simple chatbot that can understand sentences that participants train it to recognize; or 2) a Do-It-Yourself (DIY) snack sorter able to classify and categorize cereal and marshmallow.

- **Module 2. Envisioning AI for local industries:** In Module 2, the participants will envision and co-design AI systems for local industries. This process will help them develop a foundation to prepare for potential future work environments. In the long history of automation, emerging technologies have often replaced non-managerial workers (Suchman, 1995; Acemoglu and Restrepo, 2017). Envisioning AI systems for future workplaces will help participants self-advocate and be part of the decision-making process on how best to apply automation through AI systems.

  As a first step, we will present participants with pictures of three workplaces in manufacturing, healthcare, and public safety settings, and show them videos of interviews with workers. Alternatively, depending on the

preferences of our industry partners, we may be able to video conference with the workers rather than relying on recorded interviews. The PI has already conducted interviews with manufacturing and healthcare workers and gathered information about how AI can be useful in these workplaces in Lansing and San Diego (Taylor et al., 2019). Based on the presented information, the participants will envision how AI can improve current problems in a given work environment. Participants will also discuss how their assets (discussed as a first step of this program) can be helpful to envision AI systems in workplaces.

• **Evaluating Modules 1 & 2:** After finishing our workshops, we will conduct exit interviews with participants and their parents. We will ask participants to show us their mind map of AI to evaluate how they conceptualize AI after our literacy program. We will also ask participants and their parents to evaluate our program focusing on the pedagogy that we employed. Dr. Kim, an informal education expert, will help us develop questionnaires for these exit interviews. We will update our education program to address the issues our participants discuss. Also, the research team and librarians will evaluate the program in terms of instructional delivery, program management, reproducibility in other libraries, and the relatability of the educational materials to real life settings. We will request another review from our AB members and an external evaluator. Based on the reviews, we will update our materials.

3.4 Phase 4: Disseminating our findings and education materials (Spring 2023)

The research team will develop a website to share research outcomes, notes, and guidelines with librarians who are interested in running their own local AI literacy program. The librarians will generate guidelines together with the PI and co-PI to develop materials from a librarian's perspective to benefit other librarians across the country. The PI and co-PI will also meet with the AB to obtain feedback on the website materials.

Our website will provide access to an open-source AI education curriculum and webinars. The curriculum will contain descriptions of activities and include thorough teacher guides. The webinars will explain how we developed our modules and how we run our programs. We will also share information about potential problems with solutions and tips. MSU will host the website, and graduate students will manage it under the PIs' supervision.

The research team will disseminate their findings through library science conferences and journals, such as the Association for Library and Information Science Education (ALISE), the American Library Association (ALA), Computers in Libraries, and the International Conference on AI, Journal of the Association for Information Science and Technology, Library Quarterly). Also, through our partnership, YALSA will disseminate our webinars and education materials via their website and mailing list to libraries in all states. They will also promote our program using their multiple marketing platforms.

4 Diversity Plan

Divsersity is one of the high priority goals of this proposal, and we particularly address the following three agenda in this project considering a digital divide and inequity issues at a national level.

• **Serving youth from underserved communities:** The key strength of our proposal is the commitment to increasing diversity, accessibility, equity, and inclusion in AI education by serving youth from underserved communities. They are often unable to make use of educational programs because of their socioeconomic backgrounds. The librarians in our partner libraries will recruit local youth participants who are enrolled in school districts with high poverty rates which will include racial minorities as well as economically underserved youth. For example, student demographics of the school where SDL is located is composed of 60% Hispanic students and 74% students who are eligible for free or reduced-price lunch (National Center for Education Statistics, 2019). The population served by the Lansing public school district has a high poverty rate (41.6% in 2017) and the median income of this school district is one of the lowest in Michigan (City Data, 2019). Based on their knowledge from previous experience with working in underserved youth library programs, each librarian will recruit youth participants in their local communities. All three libraries have a strong track record with running youth programs.

• **Developing an AI education program for libraries in various forms:** We commit to diversifying the location and size of libraries to serve a diverse population of youth and communities on a national scale. We will implement the education program in three different states from the west coast (San Diego, California), to the Midwest (Lansing, Michigan), and to the east coast (New Windsor, Maryland) to reflect the diverse demographics of the United States. Our libraries also represent both mid-sized (CADL in Michigan, and CCPL in Maryland) and large libraries (SDL in California).

• **Incorporating multiple types of local industries:** Our industry-specific modules will be specialized for three different industries that serve diverse populations: healthcare, manufacturing, and public safety. Healthcare and manufacturing are the two largest industries in the United States: healthcare makes up 18% of the US GDP (PolicyAdvice, 2020), while manufacturing makes up 11% of the GDP as of 2019 (U.S. Bureau of Labor Statistics, 2020). Because of their wide coverage, the education materials can be easily adapted for people in other geographic regions. For example, Ohio, Indiana, and Georgia are all states with strong manufacturing industries. Hawaii, Iowa, and Minnesota are all states with strong healthcare industries. The public safety industry is considered an essential industry and can be found in all states.

5 National Impact

Building on the success of STEM education programs in public libraries (Ito et al., 2013; Subramaniam et al., 2012; Yip et al., 2016; Koh and Abbas, 2015), our project explores AI-focused programs in libraries. As an exploratory project, our work will establish a foundational AI education program in public libraries. This project will change the role of underserved youths from passive social actors who have limited voice in AI development, to active co-designers who can envision more socially aware and responsible AI systems for local industry and their communities. We will measure specific qualitative outcomes through individual interviews with participants and their parents at the beginning and end of the project. This evaluation process will be supported by Dr. Kim, an informal education expert. Also, we will closely collaborate with the ten librarians and YALSA. The specific outcomes that we will measure include:

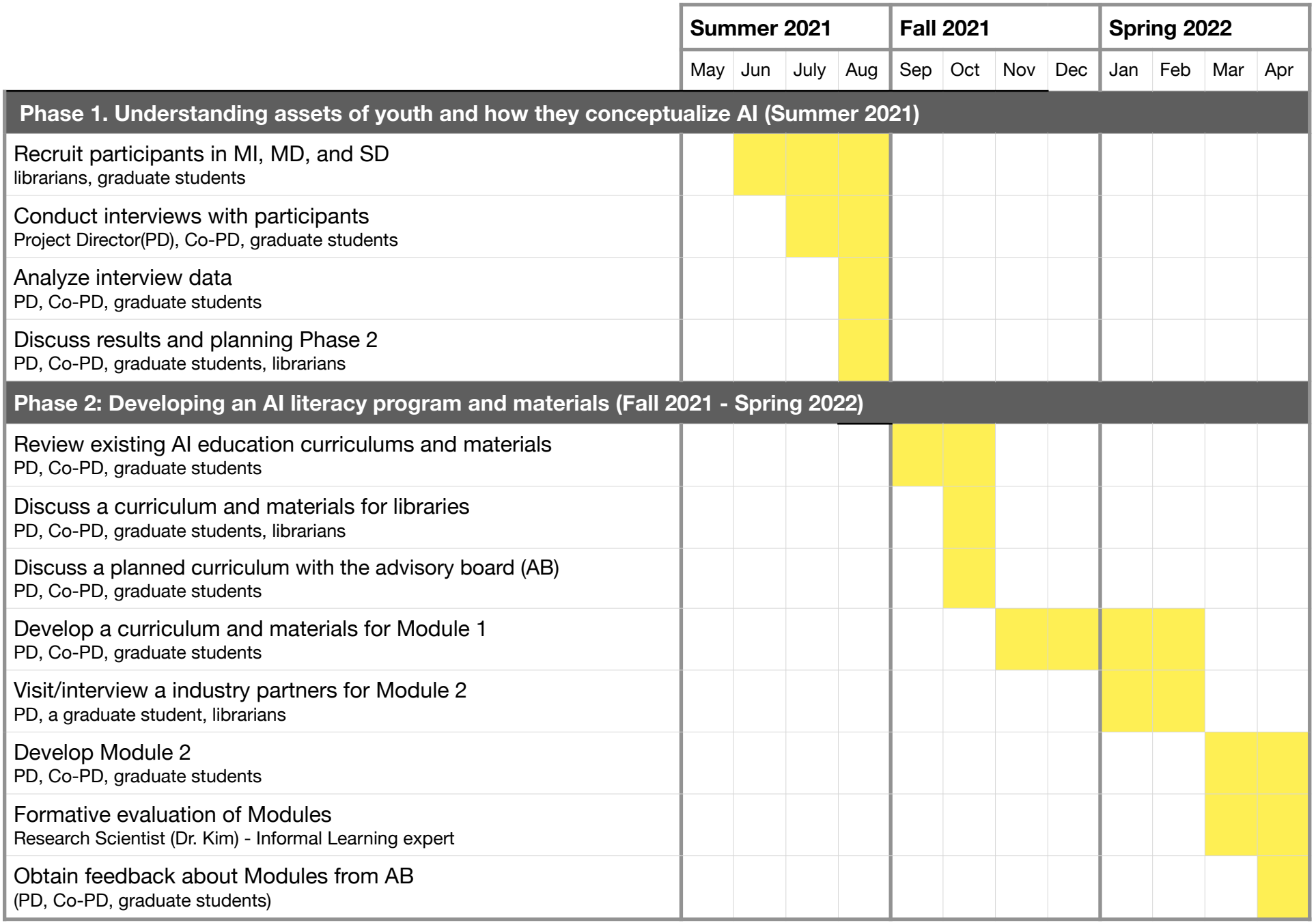
• **Developing AI literacy of youth participants:** We will evaluate how participants differently conceptualize AI from the first session to the exit interviews. We will ask participants to generate a mind map about AI at the beginning and end of the education programs. We will compare these maps to identify changes in the ways that the participants conceptualize AI.

• **Building the competence and confidence of youth and librarians:** Through the education program, participants will understand AI as a tangible system. As they learn the concepts of AI through relevant, hands-on design activities, they will increase their competence and confidence with regard to AI and their future career. Students will also learn to identify their own assets that are often ignored in conventional education settings. They will be able to connect how these assets can also be connected to AI systems. Moreover, the librarians will develop their competence and confidence with AI education programs. The librarians will gain practical knowledge about AI education and AI education materials through our iterative design process. We will evaluate changes in aptitude and attitude through qualitative interviews by specifically asking the partner librarians and participants about their competence and confidence towards AI (Koh and Abbas, 2015; YALSA, 2010).

• **Sustaining the results beyond the grant period:** We will provide guidelines and webinars to publicize our education program. The guidelines and webinars will include information targeted to interested librarians about how to implement our education materials in their libraries. The librarians will participate in the development of these materials. Most importantly, YALSA will help us generate webinars and materials, and disseminate them across the country.

• **Diversifying narratives of AI research:** Because existing AI research has been largely developed by people with similar socioeconomic backgrounds, the perspectives behind these technologies lack diversity. Involving typically youth from underserved communities in envisioning future AI technologies will infuse new perspectives into AI research. Public libraries are in a unique position to lead the charge by facilitating the inclusion of the broader community through AI literacy programs.

YEAR 1


Summer 2021
Fall 2021
Spring 2022
May
Jun
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Phase 1. Understanding assets of youth and how they conceptualize AI (Summer 2021)
Recruit participants in MI, MD, and SD
librarians, graduate students
Conduct interviews with participants
Project Director(PD), Co-PD, graduate students
Analyze interview data
PD, Co-PD, graduate students
Discuss results and planning Phase 2
PD, Co-PD, graduate students, librarians
Phase 2: Developing an AI literacy program and materials (Fall 2021 - Spring 2022)
Review existing AI education curriculums and materials
PD, Co-PD, graduate students
Discuss a curriculum and materials for libraries
PD, Co-PD, graduate students, librarians
Discuss a planned curriculum with the advisory board (AB)
PD, Co-PD, graduate students
Develop a curriculum and materials for Module 1
PD, Co-PD, graduate students
Visit/interview a industry partners for Module 2
PD, a graduate student, librarians
Develop Module 2
PD, Co-PD, graduate students
Formative evaluation of Modules
Research Scientist (Dr. Kim) - Informal Learning expert
Obtain feedback about Modules from AB
(PD, Co-PD, graduate students)

YEAR 2

	Summer 2022				Fall 2022				Spring 2023			
	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
3.3 Phase 3: Running AI literacy programs in three libraries (Summer 2022- Fall 2022)												
Recruit participants for literacy programs (PD, Co-PD, graduate students, librarians)												
Run Module 1 and Module 2 in MI (PD, Co-PD, graduate students, CADL librarians)												
Evaluate Module 1 and Module 2 in MI (PD, Co-PD, graduate students, CADL librarians)												
Analyze CADL data and redesign materials based on the analysis (PD, Co-PD, graduate students, CADL librarians)												
Obtain feedback about MI data from AB (PD, Co-PD, graduate students)												
Rune Module 1 and Module 2 in SD and MD (PD, Co-PD, graduate students, SD & MD librarians)												
Evaluate Module 1 and Module 2 in SD and MD (PD, Co-PD, graduate students, SD & MD librarians)												
Analyze SD/MD data & redesigning materials based on the analysis (PD, Co-PD, graduate students, SD & MD librarians)												
3.4 Phase 4: Disseminating our findings and education materials (Spring 2023)												
Develop a website to share research outcomes and guideline (PD, Co-PD, graduate students, librarians, YALSA)												
Obtain feedback about the website from AB (PD, Co-PD, graduate students, YALSA)												
Publishing papers to disseminate findings (PD, Co-PD, graduate students, librarians, YALSA)												

DIGITAL PRODUCT FORM

INTRODUCTION

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to digital products that are created using federal funds. This includes (1) digitized and born-digital content, resources, or assets; (2) software; and (3) research data (see below for more specific examples). Excluded are preliminary analyses, drafts of papers, plans for future research, peer-review assessments, and communications with colleagues.

The digital products you create with IMLS funding require effective stewardship to protect and enhance their value, and they should be freely and readily available for use and reuse by libraries, archives, museums, and the public. Because technology is dynamic and because we do not want to inhibit innovation, we do not want to prescribe set standards and practices that could become quickly outdated. Instead, we ask that you answer questions that address specific aspects of creating and managing digital products. Like all components of your IMLS application, your answers will be used by IMLS staff and by expert peer reviewers to evaluate your application, and they will be important in determining whether your project will be funded.

INSTRUCTIONS

If you propose to create digital products in the course of your IMLS-funded project, you must first provide answers to the questions in **SECTION I: INTELLECTUAL PROPERTY RIGHTS AND PERMISSIONS.** Then consider which of the following types of digital products you will create in your project, and complete each section of the form that is applicable.

SECTION II: DIGITAL CONTENT, RESOURCES, OR ASSETS

Complete this section if your project will create digital content, resources, or assets. These include both digitized and born-digital products created by individuals, project teams, or through community gatherings during your project. Examples include, but are not limited to, still images, audio files, moving images, microfilm, object inventories, object catalogs, artworks, books, posters, curricula, field books, maps, notebooks, scientific labels, metadata schema, charts, tables, drawings, workflows, and teacher toolkits. Your project may involve making these materials available through public or access-controlled websites, kiosks, or live or recorded programs.

SECTION III: SOFTWARE

Complete this section if your project will create software, including any source code, algorithms, applications, and digital tools plus the accompanying documentation created by you during your project.

SECTION IV: RESEARCH DATA

Complete this section if your project will create research data, including recorded factual information and supporting documentation, commonly accepted as relevant to validating research findings and to supporting scholarly publications.

SECTION I: INTELLECTUAL PROPERTY RIGHTS AND PERMISSIONS

A.1 We expect applicants seeking federal funds for developing or creating digital products to release these files under open-source licenses to maximize access and promote reuse. What will be the intellectual property status of the digital products (i.e., digital content, resources, or assets; software; research data) you intend to create? What ownership rights will your organization assert over the files you intend to create, and what conditions will you impose on their access and use? Who will hold the copyright(s)? Explain and justify your licensing selections. Identify and explain the license under which you will release the files (e.g., a non-restrictive license such as BSD, GNU, MIT, Creative Commons licenses; RightsStatements.org statements). Explain and justify any prohibitive terms or conditions of use or access, and detail how you will notify potential users about relevant terms and conditions.

The digital products we intend to create will be licensed under the Creative Commons Attribution 3.0 License. By doing so, anyone is free to copy and redistribute our materials, including the open-source AI education curriculum, as long as they give appropriate credit. People also can remix, transform, and build upon our materials as long as they explicitly state that the changes were made. We choose this type of license because we want many librarians to implement our curriculum in their libraries and add their own modules to our curriculum.

A.2 What ownership rights will your organization assert over the new digital products and what conditions will you impose on access and use? Explain and justify any terms of access and conditions of use and detail how you will notify potential users about relevant terms or conditions.

Because the digital products will be under the Creative Commons Attribution 3.0 License, our organizations ask users to give appropriate credit and specify whether they make changes to the original content.

A.3 If you will create any products that may involve privacy concerns, require obtaining permissions or rights, or raise any cultural sensitivities, describe the issues and how you plan to address them.

We will collect data from youth participants, their parents, and teachers through interviews. We will make sure to assign codes to their private information, such as names, and use the indirect identification method to refer the original data to keep their private information to our team. If we need to release photos or videos where participants' faces are in, we will get approval from the participants and their parents by asking them to fill out the photo and video consent and release form.

SECTION II: DIGITAL CONTENT, RESOURCES, OR ASSETS

A.1 Describe the digital content, resources, or assets you will create or collect, the quantities of each type, and the format(s) you will use.

Word Documents:- Interviews before and after AI programs- Qualitative data analysis results- Pre-questionnaire for libraries asking participants' current understanding of AI and quantitative and qualitative feedback from the librarians- Clear literature review of existing education materials that provide an overview of AI literacy programs for librarians who might want to customize our education materials - AI education program and publications based on the dataVideos and Images: Video and picture data illustrating workplaces

A.2 List the equipment, software, and supplies that you will use to create the digital content, resources, or assets, or the name of the service provider that will perform the work.

The PIs and research assistants will use computers provided by MSU and IU to create digital content, resources, or assets. To process the interview data, we will use NVivo, a software widely used for the analysis of unstructured text data such as interview transcripts.

A.3 List all the digital file formats (e.g., XML, TIFF, MPEG, OBJ, DOC, PDF) you plan to use. If digitizing content, describe the quality standards (e.g., resolution, sampling rate, pixel dimensions) you will use for the files you will create.

Videoformat: MPEG-4 Part 14, Resolution: 1024 × 768, sampling rate: 48kHz
ImageFormat: JPEG

Workflow and Asset Maintenance/Preservation

B.1 Describe your quality control plan. How will you monitor and evaluate your workflow and products?

The PIs will keep checking the quality of the digital products. Whenever the entire team, including the PIs and graduate students, have a meeting with the librarians and the advisory board, they will monitor and evaluate the workflow and products.

B.2 Describe your plan for preserving and maintaining digital assets during and after the award period. Your plan should address storage systems, shared repositories, technical documentation, migration planning, and commitment of organizational funding for these purposes. Please note: You may charge the federal award before closeout for the costs of publication or sharing of research results if the costs are not incurred during the period of performance of the federal award (see 2 C.F.R. § 200.461).

All data generated for this project will be stored on the Google Drive offered by both

institutions. All the records there are protected under FERPA (The Family Educational Rights and Privacy Act, 20 U.S.C. § 1232g; 34 CFR Part 99). Some of them will be released by the project website hosted on a MSU IT server in the Computer Center Data Center.

Metadata

C.1 Describe how you will produce any and all technical, descriptive, administrative, or preservation metadata or linked data. Specify which standards or data models you will use for the metadata structure (e.g., RDF, BIBFRAME, Dublin Core, Encoded Archival Description, PBCore, PREMIS) and metadata content (e.g., thesauri).

We will use Dublin Core Metadata for the metadata structure because of its strengths. All team members can learn how to use the standard quickly because it is easy to implement. Moreover, the digital content on the project website is more accessible to librarians since the search engines can take advantage of the metadata.

C.2 Explain your strategy for preserving and maintaining metadata created or collected during and after the award period of performance.

The metadata will be stored on the Google Drive offered by both institutions during and after the completion of the project.

C.3 Explain what metadata sharing and/or other strategies you will use to facilitate widespread discovery and use of the digital content, resources, or assets created during your project (e.g., an API [Application Programming Interface], contributions to a digital platform, or other ways you might enable batch queries and retrieval of metadata).

YALSA will promote our program using its multiple marketing methods, such as YALSA blog postings and weekly news. Also, the PIs will advertise our digital content generated during our project by actively participating in various conferences, such as Association for Library and Information Science Education, the International Conference on AI for Libraries, and Conference on Human Factors in Computing Systems. We will also use SNS platforms, such as Facebook and Instagram, to make our work more accessible.

Access and Use

D.1 Describe how you will make the digital content, resources, or assets available to the public. Include details such as the delivery strategy (e.g., openly available online, available to specified audiences) and underlying hardware/software platforms and infrastructure (e.g., specific digital repository software or leased services, accessibility via standard web browsers, requirements for special software tools in order to use the content, delivery enabled by IIIF specifications).

We will share our open-source AI education curriculum and webinars through YALSA's website and the project website hosted by MSU. People can access the data using standard web

browsers.

D.2. Provide the name(s) and URL(s) (Universal Resource Locator), DOI (Digital Object Identifier), or other persistent identifier for any examples of previous digital content, resources, or assets your organization has created.

Project Name:MSU Academic Network
URL: https://d.lib.msu.edu/academic-program-profiles

SECTION III: SOFTWARE

General Information

A.1 Describe the software you intend to create, including a summary of the major functions it will perform and the intended primary audience(s) it will serve.

Not applicable for this project

A.2 List other existing software that wholly or partially performs the same or similar functions, and explain how the software you intend to create is different, and justify why those differences are significant and necessary.

Not applicable for this project

Technical Information

B.1 List the programming languages, platforms, frameworks, software, or other applications you will use to create your software and explain why you chose them.

Not applicable for this project

B.2 Describe how the software you intend to create will extend or interoperate with relevant existing software.

Not applicable for this project

B.3 Describe any underlying additional software or system dependencies necessary to run the software you intend to create.

Not applicable for this project

B.4 Describe the processes you will use for development, documentation, and for maintaining and updating documentation for users of the software.

Not applicable for this project

B.5 Provide the name(s), URL(s), and/or code repository locations for examples of any previous software your organization has created.

Access and Use

C.1 Describe how you will make the software and source code available to the public and/or its intended users.

Not applicable for this project

C.2 Identify where you will deposit the source code for the software you intend to develop:

Name of publicly accessible source code repository:

Not applicable for this project

URL:

Not applicable for this project

SECTION IV: RESEARCH DATA

As part of the federal government's commitment to increase access to federally funded research data, Section IV represents the Data Management Plan (DMP) for research proposals and should reflect data management, dissemination, and preservation best practices in the applicant's area of research appropriate to the data that the project will generate.

A.1 Identify the type(s) 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.

RQ 1: Interviews with participants, their parents, and teachers; Qualitative data showing how participants conceptualize AI; Pre-questionnaire for libraries asking participants' current understanding of AI
RQ 2:Clear literature review of existing education materials that provide an overview of AI literacy programs for librarians who might want to customize our education materials; a Finalized outline of our AI education program
RQ 3:Clear list of core AI education materials; Video and picture data illustrating workplaces

Qualitative data explaining current issues of each workplace and potential needs of AI for the issues
RQ 4: Quantitative and qualitative feedback from the librarians; A plan of updating existing education materials to increase replicability
RQ 5: Interviews with participants, their parents, and the librarians after AI programs; Qualitative evaluation data of the AI education program from the participants and parents; Publications based on the data

A.2 Does the proposed data collection or research activity require approval by any internal review panel or institutional review board (IRB)? If so, has the proposed research activity been approved? If not, what is your plan for securing approval?

Yes, the proposed data collection and research activity require review and approval from an institutional review board (IRB.) We will submit an IRB review once this project gets funded.

A.3 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.

During recruiting participants, we will collect personally identifiable information, including names and phone numbers. We will store the information on our encrypted computer drives. We will also protect computers with strong passwords.

A.4 What technical (hardware and/or software) requirements or dependencies would be necessary for understanding retrieving, displaying, processing, or otherwise reusing the data?

We will use NVivo to process the data collected from the interview. NVivo is used for the analysis of unstructured text data such as interview transcripts.

A.5 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?

We will generate codebooks from the interview data using NVivo.We will store the information on our encrypted computer drives and Google Drive provided by MSU and IU. We will also protect computers and Google Drive with strong passwords. We will associate all data using codes that are linked to the participant's identity.

A.6 What is your plan for managing, disseminating, and preserving data after the completion of the award-funded project?

We will preserve the data on our Google Drive with secure encryption after the completion of the project. MSU will host the project website to provide an open-source AI education curriculum and the webinars. We will also disseminate findings through library science conferences, library science journals, and Human-Computer interaction conferences.

A.7 Identify where you will deposit the data:

Name of repository: MSU's Google Drive

URL: https://googleapps.msu.edu

A.8 When and how frequently will you review this data management plan? How will the implementation be monitored?

We will review the data management plan every six months. We will keep monitoring the implementation to make sure that the private data is stored safely and confidentially. In particular, we will give collaborators, including librarians and students, a training session on how to handle the data ethically and safely.