ALLMs: Assessment for Learning in Library Makerspaces

ALLMs: Assessment for Learning in Library Makerspaces project is a research-practice collaboration between the University at Buffalo-SUNY, the University of Wisconsin-Madison, the Buffalo and Erie County Public Library, and the Madison Public Library. The project will involve library staff and researchers co-designing and studying assessments of learning and engagement in Makerspaces. The focus will be to study and develop assessment tools, including a planning map with adaptable assessments, that will support librarians' development of assessment literacies for promoting lifelong learning (IMLS, 2018) in Making and similar hands-on learning experiences.

The increasing number of innovative learning experiences offered in libraries, (e.g., Makerspaces, Learning Labs, Fab Labs) presents important opportunities and challenges for librarians. Librarians need tools and approaches to document and assess maker-based learning and other ambitious learning experiences, part of what Koh and Abbas (2015) call facilitating learning. Patrons need formative and summative feedback for the novel but important learning they gain in libraries. Finally, guidance on what to do with assessment data is needed for all, since assessment is only valuable if it leads to positive action.

Between October 1, 2018 and September, 30, 2021, ALLMs will combine three phases of design-based research into an assessment toolset that can then be adapted for use in all Library Makerspaces. **Phase one** is research to identify the information and feedback needs of patrons, librarians, and stakeholders (e.g., board of governors) of a library Makerspace. An iterative design-based research process (Barab & Squire, 2004) will then focus on developing an initial assessment map to document and interpret the evidence of learning that can be used in a library Makerspaces.

Phase two will connect additional information from libraries serving different populations (e.g. city, rural, suburban) into the design of an assessment planning map that can then be used to identify the assessment needs of different Library Makerspaces and what assessments can then meet those needs. Not only will assessment tools and routines be tested for compatibility with the planning map, but how library staff are trained to use the tools and routines will also be tested, with the expectation that ongoing professional development will be self-sustaining outside of this research project. Feedback from this prototyping will enable the project team to refine the maps, tools, and routines to enable rapid adoption at scale.

Phase three will finalize the assessment tools and documentation and organize two regional workshops that can draw on a range of librarian communities within a geographic area (Western New York, Upper-Midwest). These librarians will engage with the tools and provide constructive feedback to ensure utility at scale. The toolkit will be openly licensed, available for download from several websites, and optimized for libraries that require printed materials. The toolkit will include: adaptable assessment maps, adjustable assessment tools (e.g., surveys, observations protocols), supporting documentation (e.g., example procedures, scaffolds for assessment theory, and reflective prompts that enable deep thinking on assessment), and guided instruction for helping librarians develop their own assessment tools. In addition, all toolkits and publications will be disseminated through conference workshops (e.g., PLA, YALSA, ARSL), online communities (e.g. YOUMedia Community of Practice), and websites (e.g., Maker Ed resource page, makingandlearning.org).

The ALLMs team will also publish associated research, conducted in conjunction with the assessment development. Our research questions are:
1. What are the expected learning goals among patrons and librarians for Makerspaces?
2. What constitutes useful evidence of learning goals among patrons and librarians in Makerspaces?
3. In what ways does documentation of learning inform the work of librarians, patrons, and other library stakeholders?

ALLMs: Assessment for Learning in Library Makerspaces

<u>Project Summary</u>
University at Buffalo SUNY proposes *Assessment for Learning in Library Makerspaces (ALLMs),* a research-practice collaboration with the University of Wisconsin-Madison, the Buffalo and Erie County Public Library, and the Madison Public Library (Requested Budget of $346,043) though the IMLS National Leadership Grant for Libraries program. The focus of the project is the collaborative study and design, by researchers and librarians, of assessments of learning and engagement in library-based Makerspaces. The goal of the project is to support lifelong learning (IMLS, 2018) through the development of a suite of assessment tools for Maker-based and similar hands-on learning experiences - including a planning map and accompanying assessment tools that enable selection and adaptation of assessments by Librarians and other library-based stakeholders. By developing assessment and evaluation tools to make evidence-based claims about learning and engagement in library Maker programs, this project aligns with IMLS's strategic plan support lifelong learning and build the capacity of library professionals. This project proposes to do this by working to "support cross-disciplinary and inquiry-based methods of learning within museums and libraries" and support library professionals to share and adopt best practices and innovations (IMLS, 2018)."

Statement of National Need
Making and learning in Makerspaces has been characterized by interest-driven engagement in creative production at the crossroads and fringes of disciplines such as science, technology, engineering, art, and math, and has developed into a recognized social, technological and economic movement (Sheridan et al., 2014; Wardrip, Brahms, Carrigan & Reich, 2016; Dougherty, 2016). Making has emerged as an engaging entry point and activity for STEM education (Honey & Kanter, 2013; Peppler & Bender 2013), workforce development (Anderson, 2012; Hatch, 2014) and the development of innovative and entrepreneurial skills (Benton, Mullins, Shelley & Dempsey, 2013; Hirshberg, Dougherty & Kadanoff, 2016), and technical literacy (Lande & Jordan, 2014). No matter the goal, making and Maker programs have developed momentum as an educational movement in schools and informal learning environments.

Increasingly, more and more Maker-based and similar hands-on learning experiences (e.g., Makerspaces, Learning Labs, Fab Labs) are being offered in libraries across the United States. While it is difficult to state the number of library Makerspaces that exist nationwide, there are some indicators to suggest that these learning spaces and experiences are becoming prevalent. For example, at the time this proposal was written, the IMLS grants database listed 13 funded projects under the search terms library and Makerspace (https://www.imls.gov/grants/awarded-grants). The Urban Libraries Council notes a growing list of 43 maker-focused programs in library systems nationwide, in addition to over 100 member libraries committed to offering creative, Maker experiences (https://www.urbanlibraries.org/member-resources/makerspaces-in-libraries). The Library Journal surveyed over 7000 public libraries in North America about making and found 89% of respondents claimed to offer some kinds of Maker activities (Dixon, 2017).

Driven by increasing access to new technologies, these innovative learning experiences are a natural evolution of what libraries offer their communities. Patrons of a library with a Makerspace can have access to emerging technology for skill building and project-related goals. However, in addition to new opportunities for learning, the addition of a Makerspace to a library can also be a challenge for librarians, patrons, and other library stakeholders (e.g., elected officials, library board of directors, local business) who are invested in the success of their libraries. As *anchors for their communities*, libraries must have access to data that can lead to improved, equitable learning. Librarians need tools and approaches to document and

assess Maker-based learning and other ambitious learning experiences, part of what Koh and Abbas (2015) call facilitating learning. Patrons need formative and summative feedback for the novel but important learning they gain in libraries. Finally, guidance on what to do with data is needed for all, since data is only valuable if it leads to positive action.

We suggest that high-quality assessments, and their accompanying tools and supports, can strengthen the learning opportunities offered by making in libraries as well as help a Makerspace contribute to a library's efforts to serve its community. Assessment is much more than a test or way to measure learning; it is an important practice for effective learning opportunities. Specifically, the generation of assessments that generates formative and summative feedback is integral to robust learning (The Gordon Commission, 2013). Applied to library Makerspaces, assessments should help both patrons and librarians recognize what is learned (i.e., summative assessment) and generate constructive feedback that will lead to improved learning outcomes (i.e., formative assessment). A summative assessment can serve as a credential of whether something is learned, while the absence of a summative assessment could indicate that either something is not learned or there is no verification of what is learned (e.g., knowing how to use a 3D printer, being capable of tutoring others on how apply a design process). A formative assessment enables either a learner or their instructor to shape or improve the learner's competence (Sadler, 1989). Constructive feedback or the opportunity for reflection are both examples of formative assessment. In a Makerspace, formative assessment can inform a patron or librarian how close the learner is to completing their goal (i.e., why they came to the library Makerspace) or what other skills or experience are needed.

Assessments are also a means for generating data that can inform both librarians and library stakeholders of how a library-based Makerspace is contributing to the core mission of the organization. For example, a library may have a Makerspace to meet specific community needs or to address patron technical literacy. Assessment data can then inform how the Makerspaces is meeting that need or what needs to be altered in order to better reach the goal for creating the Makerspace. A library may also create a Makerspace to complement other library services, such as formalized courses or youth education programs. The data generated by Maker-specific assessments, used in conjunction with standard library assessment practices (e.g., patron attendance, material circulation, librarian observations) can help determine how a Makerspace contributes to a library. ***This is especially important as libraries are increasingly asked to provide more justification for their budgets***. Assessment data can be used to address critics of Making or libraries, who often ask a variation of the question, "Well, it looks like fun…[pause]…but are they learning?" (Petrich, Wilkinson and Bevan, 2013) Data generated by assessments can explain what is being learned and who is learning, allowing a library to directly justify how a Makerspace serves its patrons and the community at large.

We note that while there is emerging, quality research on assessment in Makerspaces, there is a dearth of research that focuses on the unique assessment needs of Making in Libraries. An assessment designed to address Making in a museum, must also address how the museum will "engage in collection, acquisition and exhibition of the material evidence of people, and their culture and environment" (Edwards, 2005). Even though there is overlap between Makerspaces in different contexts, a library Makerspace must also serve the core mission of the library, which can include providing community information, supporting lifelong learning for all patrons, and advocating for information and technology literacy (Bishop, Tidline, Shoemaker, & Salela, 1999). A library-based Makerspace cannot just be a 'cool, new idea'; it must be justified with data that explains how it serves the core mission of a library - data that can be generated by assessment specifically designed for library-based Making.

A frequent criticism of assessment is that that it is meaningless outside of the context where it is generated. For example, receiving an A in a math class does not explain much about what someone know and does not

know about math outside of the direct context of formalized instruction (and still may not accurately reflect someone's mastery of skills or knowledge). Applied generally to Making and to library-based Makerspaces specifically, assessments and accompanying data will have minimum effect without guidance and examples of how assessment data can inform practice or lead to next-steps. If assessments for library-based Makerspaces are to support learning, then not only do the assessments need to be generated and evaluated according to the goals of the Makerspace and library, but additional supports (e.g., training materials, example reports) need to be generated on how librarians, patrons, and other stakeholder can optimally use the specific assessments and data.

There is notable evaluation research and work being done in library Makerspaces. For example, the National Girls Collaborative Project evaluated librarians' knowledge and attitudes of STEAM education through a program partnership program between the LA Makerspace and 160 librarians (Stephenson, 2018). The MIT Teaching Systems Lab recently received a grant to develop assessments of Maker-based learning experiences in schools (Yorio, 2018). Other research has been funded to support assessment work in museums (e.g., Children's Museum of Pittsburgh) and connected learning in libraries (e.g., UC-Irvine).

This proposal is unique in that it will combine three phases of design-based research into an assessment toolset that can then be adapted for use in all library Makerspaces. Assessment of learning and engagement in library Makerspaces is different from museums and schools in a variety of ways, such as time spent, frequency of use by learners, greater access for learners and the broad learning focus (i.e., not tied to content area learning like in a school or a general theme like in a museum). Assessment used in library Makerspaces must be adaptable to the challenges of understanding learning in a library and cannot consistently reply on known, fixed learning experiences. For example, a librarian will need to implement assessments for both specific learning opportunities (e.g., a class on using a 3d printer, a fabric workshop) as well as when patrons may 'drop-in' to the Makerspace for a purpose and amount of time that is unknowable prior to their arrival. The latter example can be a frequent use of a library Makerspace but one of the most difficult to assess since there is no opportunity to plan the assessment.

Project Design
The collaborators on this project will study and design assessments of learning and engagement in library-based Makerspaces.

Phase One is devoted to research to identify the information and feedback needs of patrons, librarians, and stakeholders (e.g., board of governors, local businesses) of a library Makerspace. Because libraries serve a wide of range of needs mandated by the local community, a library-based Makerspace may expect a similar variety of needs and uses. However, just as libraries have similar enough purposes so as to benefit from shared knowledge, it is reasonable to expect the same for library-based Makerspaces. Consequently, the first phase of the *ALLMs* project is to identify what are assessment needs of library-based Makerspaces and how are they similar so as to facilitate knowledge sharing.

Phase Two of the *ALLMs* project is matching the different information and feedback needs of library Makerspaces into the design of an assessment planning map that can then be used to match the assessment needs to what assessment tools can then meet those needs (Figure 1). For example, a librarian may need to determine whether patrons achieve a basic level of mastery in a specific technology located in the Makerspace in order to determine if the patron need further assistance. The librarian may also need to determine how engaged a patron is in a specific activity associated with the technology as part of a broader effort in creating more engaging Makerspace activities. Consulting an assessment map would reveal that a self-assessment tool, where the patron reflects both on their mastery of the technology and interest in the

activity, would provide data that could allow the librarian to make their sought-after determinations. The librarian could then select from a collection of pre-generated self-assessments, make any necessary modifications, and then implement an optimal assessment.

The final, *Phase Three* will be the study and development of providing patrons, librarians, and stakeholders with recommendations and examples of what to do with the data generated through assessments. This last part of the assessment cycle, acting on assessment data, is too often deprioritized because of the challenge of creating and implementing an assessment. However, knowing what to do with assessment data is fundamental to both improving learning opportunities and measuring impact. In the example provided in Phase Two, the librarian may have selected the right assessment, but could be still unsure how the data from the assessment can inform a decision or next-step. A collection of assessment tools, however optimally chosen, still needs to lead to informed decision making in order to have value – data is not alone valuable. Consequently, we will evaluate *ALLMs* by examining the degree to which libraries improve learning in Makerspaces based on our assessment tools. In other words, the value of *ALLMs* is the degree to which it leads to constructive action based on assessment.

Figure 1: Example of Assessment Planning Map
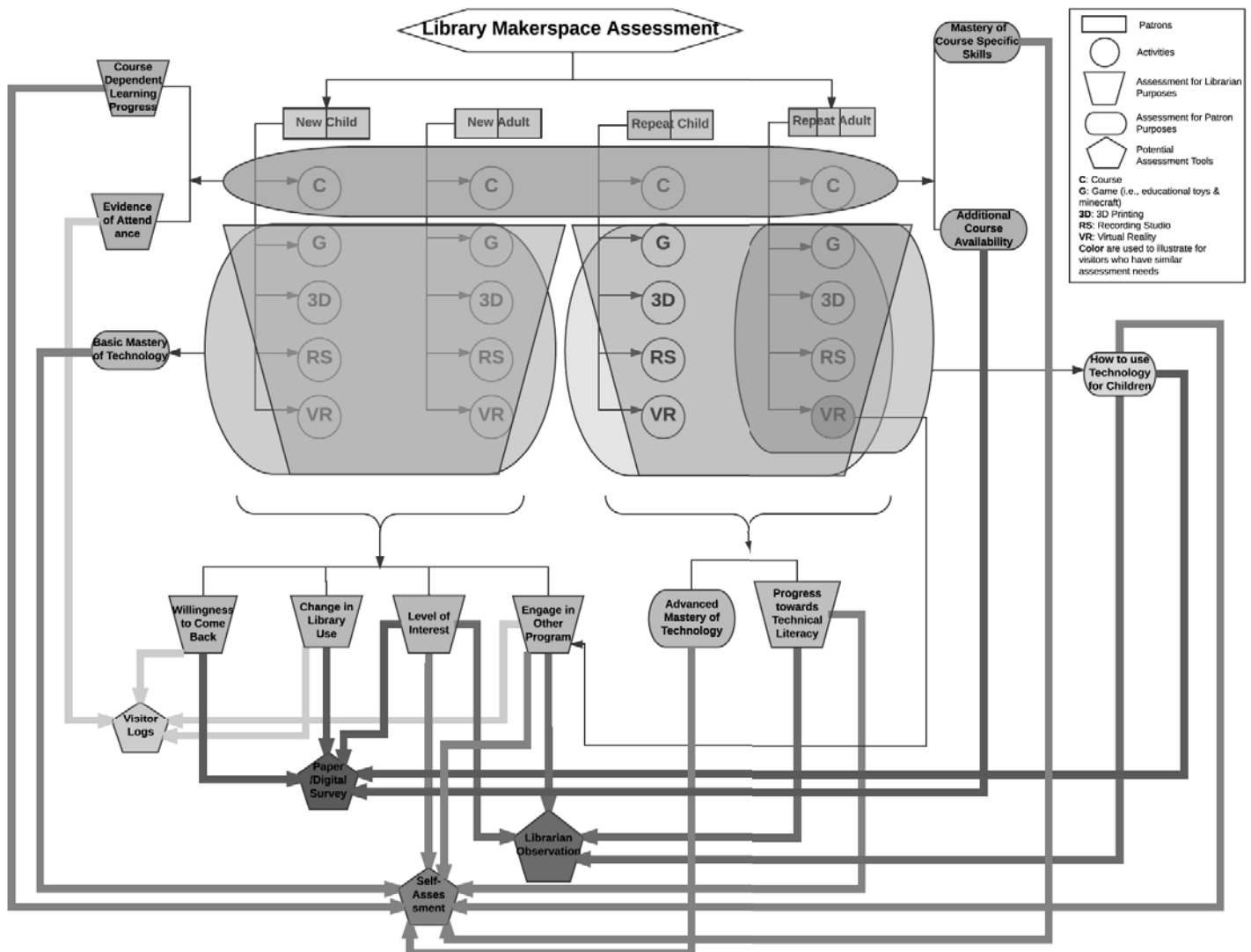
The three phases of our research will be completed in corresponding years that would begin October 1, 2018 and end September 30, 2021. Our initial research sites will be the central branch of the Buffalo and Erie County Public Library (B&ECPL), and the Bubbler Makerspace of Madison Public Library. In year two, research sites will be expanded into other branches of the respective library systems that have Makerspaces - which include urban, suburban, and rural communities in the case of B&ECPL. National dissemination will take place in year three.

The university partners are Dr. Samuel Abramovich at the University at Buffalo, an expert in Assessment and Open Education, and Dr. Peter Wardrip at the University of Wisconsin – Madison, an expert in Assessment, Informal Learning, and Making as a learning process. Both are trained as Learning Scientists and have extensive expertise with Design Based Research (Barab, 2014), a methodology that allow for simultaneous development of empirical research and educational design in real-world learning settings.

The Buffalo & Erie County Library (B&ECPL), NY and the Madison Public Library, WI will serve as the library partners on *ALLMs*. Led by Mary Jean Jakubowski, the director of B&ECPL's 37 libraries, the Launch Pad was created as a pilot Makerspace within B&ECPL's Downtown Central branch. Designed for hands-on learning experiences where all patrons, children and adults (even Buffalonians without a library card), can drop-in for any length of time and learn new skills, create virtual & physical projects, and collaborate, the Launch Pad is typical of many library Makerspaces where there is a wide variety of learning opportunities available for patrons with vastly different prior experiences. This alone would present a significant challenge to creating useful assessments - not knowing the age, prior experience, or how long a learning experience may take place - but the challenge is further compounded by patrons who might not want to provide personal information (often for good reasons). Tests, surveys, and observation tools that are successful in measuring learning in other Makerspaces are not necessarily applicable in Library Makerspaces. Yet the patrons served by B&ECPL's downtown Buffalo branch as well as the library branches in rural parts of Erie County are typical of many underserved populations, who need fully developed learning spaces that include assessments.

In addition, Madison Public Library's Bubbler will also serve as a partner site on the project. The Bubbler is a hub that connects artists to the community and the community to artists through free, hands-on making, exhibitions, and community-wide events. The Bubbler has been a national leader in creating and facilitating arts-based Makerspaces, partnering with the UW I-School in the development of their Maker-based programming (e.g. Halverson, Lakind & Willett, 2017). The Bubbler's youth programming is led by Rebecca Millerjohn, the Teaching and Learning Librarian (CV in supplemental materials). She will partner with the UW team in the project's efforts.

Table 1: Summary of Research Carried Out in Phases

Phase	Research Questions	Data Addressing the Question
1	What are the expected learning goals among patrons and librarians for Makerspaces?	Patron and staff surveys, Patron and staff interviews, Meeting documentation
2	What constitutes useful evidence of learning goals among patrons and librarians in Makerspaces?	Patron and staff surveys, Patron and staff interviews, Meeting documentation, Researcher Observations
3	In what ways does documentation of learning inform the work of librarians, patrons, and other library stakeholders?	Patron and staff surveys, Patron and staff interviews, Meeting documentation, Researcher Observations

The research questions (Table 1) will be iteratively addressed in phases one and two of *ALLMs*. The third phase will be focused on the dissemination of the work. Each phase will be carried out with each site (Madison and Buffalo) with a researcher and library staff collaborating and co-designing tools. Local meeting routines will be established to meet the needs and rhythms of each library. In addition, monthly opportunities will be created for the two sites to meet, update and share their work.

Phase One/Year One: Development
In the first year of this project, the research team will work with a team of library staff from the Launch Pad and the Bubbler, through a combination of observation protocols and structured interviews with librarians, patrons, and other stakeholders (e.g., board of governors, library volunteer educators), to continue work on identifying priorities for learning in the space and articulate what that learning looks like. An iterative design-based research process (Barab & Squire, 2004) will begin, continuing into year two, on developing an assessment map and tools to document and interpret the evidence of learning that can be used in a library Makerspaces. These tools might include but are not limited to: an observation protocol for librarians, self-assessment questionnaires for patrons, artifact collection, peer-feedback, and a note-taking tool. This development process will be supported by Dr. Wardrip and a graduate student with the Bubbler and Dr. Abramovich, a graduate student, and library staff with the Launchpad.

This work will be focused on three primary development activities:

a. *Assessment Criteria development:* Building on the interviews with various stakeholders, each library will identify constructs, which will serve as goals or priorities of learning and engagement in their Maker-based learning experiences. As meaningful constructs are identified, each local team will identify criteria which constitute engagement in the construct. This process of listing evidential criteria for learning and engagement goals is a form of assessment literacy and is intended not only to be a meaningful form of co-design (Kwon, Wardrip & Gomez, 2014), but also meant to build assessment literacy among the site teams (e.g., Popham, 2009).
b. *Assessment Instrument development*: With a list of criteria that constitute engagement in each library's learning goals, each library will develop instruments that enable the collection of evidence. This process of focusing on evidence of engagement informing the tool and task design is informed by the evidence-centered design process (ECD) (Kim, Almond & Shute, 2016). The instrument (survey, observation tool, performance tasks, etc.) will be developed to meet the needs of the libraries' goals and priorities as well as their local practice. Each library team will co-design instruments to assess engagement in their prioritized constructs.
c. *Assessment Protocol development*: As an instrument is developed, each team will develop an accompanying protocol. The protocol is meant to be a consistent means for using the instrument or tool. However, we might think of it as playing two roles. First, the protocol can ensure that the user of the assessment tool is using or administering it in a common fashion. Second, a protocol can be a common set of guidelines for discussing and reflecting on patron learning and engagement. Thus, the protocol development will support both the use of an assessment tool in gathering evidence as well as the discussion and reflection of that evidence after the fact.

Phase Two/Year Two: Testing and Refinement
In the second year, the prototype assessment tools and protocols will be tested and revised in the respective libraries' Maker programs in both Madison and Buffalo. The advisory board, selected for their expertise in Making, assessment, and informal education, will provide external feedback on the tools and protocols of use. Not only will the tools and routines be tested, but how library staff are trained to use the tools and routines will also be tested, with the expectation that ongoing professional development will be self-

sustaining outside of this research project. Feedback from this prototyping will enable the project team to refine the maps, tools, and routines to enable rapid adoption at scale. Feedback will happen during local site-based meetings, through surveys and interviews as well as informal conversations between library practitioners and researchers.

An additional focus will be on the validity of the assessment tools. Validity is important to ensure that the evidence we gather with the assessment tools enable us to make adequate and appropriate claims about learning (Messick, 1989). Validity of the tools are also important to their development and it is important to consider that validity is not an inherent attribute of the tools, but rather a property of the tools that also depends on how they are used (McClellan, Atkinson, & Danielson, 2012). In short, our concern about validity is to ensure that the tools are measuring what we intend for them to measure. In support of this, we will consider at least three kinds of validity:

- *Content-based validity*: the alignment of what the assessment tool measures and what it intends to measure. This will be negotiated through discussions with our library partners, feedback of our advisory panel and a crosswalk comparison with other frameworks of making like the learning practices of making from the Children's Museum of Pittsburgh.
- *Structural validity*: correlations that show that there is an expected relationship among different criterion within our measurement tools. We will explore correlations that exist among the criteria we are measuring as well as using factor analysis to see if criteria coalesce into particular domain groups. For example, if resourcefulness and persistence are two constructs that are valuable to our libraries, we will be sure to explore the relationship between how we measure both constructs to ensure that they are distinct.
- *Concurrent validity*: as a form of criterion related validity, concurrent validity aims to explore the extent to which evidence of the learning and engagement that we measure is related to other appropriate learning measures. We will construct a brief survey instrument that aligns to the our measures. This brief survey, intended to not disrupt the learning experience, will enable us to look at correlations between learners' perceived engagement in what we are measuring and observers' scores on similar measures.

Phase Three/Year Three: Synthesis and dissemination
In year three, we will finalize the assessment map and tools and then disseminate them along with support materials that details how to use them and what was learned from the development process. The main thrust of the dissemination will consist of a toolkit, workshops to facilitate the use of the tools, and conference presentations/journal articles in both research and practitioner based forums.

Dissemination Workshops: The project team will design, organize and facilitate two regional workshops that can draw on a range of librarian communities within a geographic area (one in Western New York state, the other in the Upper-Midwest). These librarian workshop participants will engage with the tools, provide constructive feedback to ensure utility at scale and reflect on opportunities for using the assessment tools for their own practice. The regional workshops will be co-designed and co-facilitated by the researchers and library staff. This interactive approach to research dissemination has been seen as an effective approach for the uptake of new knowledge and practices by practitioners (Wandersman et al, 2008). The workshops will target 20-40 participants for each workshop.

Library Maker Assessment Toolkit: The tools will be consolidated into a toolkit. The toolkit will be openly licensed, available for download from several websites (e.g., makingandlearning.org, Maker Ed Resource Page), shared through online communities (e.g.; YOUmedia Community of Practice) and optimized for libraries that require printed materials. The toolkit will include: adaptable assessment maps, adjustable assessment tools (e.g., surveys, observations protocols), supporting documentation (e.g., example

procedures, scaffolds for assessment theory, and reflective prompts that enable deep thinking on assessment), and guided instruction for helping librarians develop their own assessment tools.

Conference Presentations/Journal Articles: The toolkit and publications generated from the project will be disseminated through conference presentations and workshops. The workshops will be shortened and revised versions of the two regional workshops. The project will target national conferences (e.g., ALA, PLA, YALSA, ARSL) as well as regional conferences (e.g., WLA, NYLA, ARSL/NY, Play Make Learn). Additionally, the project will also generate research and practitioner journal articles, which will be submitted to leading journals, such as *Journal of the Learning Sciences*, *Journal of Librarianship and Information Science*, *Young Adult Library Services* and the *Journal of Research on Libraries and Young Adults.*

Project Management and Partners
Dr. Sam Abramovich, Assistant Professor of Learning and Instruction, and Information and Library Studies, Director of the Open Education Research Lab, will serve as the PI and supervise the entire project as well as project activities in Buffalo. **Dr. Peter Wardrip**, Assistant Professor of STEAM Education, University of Wisconsin-Madison, will serve as co-PI and will supervise project activities in Madison as well as national outreach. **Mary Jean Jakubowski**, Director, Buffalo & Erie County Public Library, will serve as co-PI and supervise patron, librarian, and other stakeholder involvement. **Rebecca Millerjohn**, Teaching and Learning Librarian at the Madison Public Library, will be lead collaborator in Madison in the developing, testing and disseminating of assessment tools. We are fortunate to work with Rebecca as part of the focus of her job is to consider ways that the library can assess learning. The project team's CVs are available in the supplemental materials.

Project Evaluation and Monitoring Progress
A group of nationally recognized practitioner and academic advisors will play a key role in reviewing and collaborating on both the tool development process as well as what we learn about the tool's role in impacting library practitioner practice. The advisory board's explicit role is to provide expert guidance as well as monitoring and evaluation to ensure the project is effectively achieving its goals. (bios and CVs in supporting documents) **Stephanie Chang** (National Making Expert) is Director of Programs for Make Ed. **Dr. Lisa Brahms** (Maker Researcher) is Director of Learning and Research at Children's Museum of Pittsburgh. **Dr. Crystle Martin** (library learning research) is the Director of Library and Learning Resources at El Camino Community College in Torrance, California. **Dr. Jeff Evancho** (Documentation and assessment of Maker-based learning) is the Project Zero Coordinator for Quaker Valley School District in Leetsdale, Pennsylvania and co-leads Agency by Design Pittsburgh, an educator learning community focused on documentation and assessment of Maker-based learning. **Amy Holcomb** (Library Learning Design) is an Experiential Learning Coordinator at Skokie Public Library in Skokie, Illinois. **Kristin Fontchiaro** (Library Maker Professional Learning) is a clinical assistant professor at the University of Michigan School of Information.

Diversity Plan
This project intentionally is designed to provide useful tools for diverse communities as well as taking into account the needs of those communities. First, both Madison Public Library and the Buffalo and Erie Public Libraries serve the whole of their communities. In particular, the educational Maker programming that these libraries offer are not restricted by price, long-term time commitment, or even one location. The programming is accessed by a diverse cross section of the community.

Dr. Abramovich and Dr. Wardrip also have expertise on the potential impact of assessment on diverse populations. For example, Dr. Abramovich has presented research at the national conference for Culturally

Responsive Research & Assessment (CREA) while Dr. Wardrip's research frequently target diverse populations across both urban and rural populations.

Our advisory board not only reflects a wealth of expertise related to libraries, Maker education and assessment research, but they also reflect great diversity in the learners they reach. For example, Stephanie Chang has a national view of making in a variety of settings, age groups, demographics and purposes. Amy Holcomb at the Skokie Public Library works with a local population where half of the citizens speak another language than English. And Lisa Brahms's museum, Children's Museum of Pittsburgh, has been a leading museum in creating inclusive learning experiences, for example, that are sensory friendly or accessible to blind or visually-impaired visitors. The advisory board can provide feedback on the assessment tools based on their own experiences meeting the needs of learners in their own settings.

In addition, the project's approach of co-design of assessment tools is aimed at including the voice and practice of library staff and stakeholders into the design process. Co-design is an approach of involving stakeholders in the design process to ensure the utility and usefulness of what is designed (Wardrip, Gomez & Gomez, 2015). Both partner libraries are committed to working with the researchers (and vice versa) to ensure that the assessment tools are responsive to the everyday use of the library Makerspace.

Finally, the dissemination process is further intended to engage a wide range of audiences. While the toolkit will be widely and openly available online, we know that we cannot assume that availability will equate to use. Therefore, the project is designing workshops to share the use of the tools. In particular, two regional workshops will be designed and facilitated with the library partners to reach urban, suburban and, especially, rural librarians. While similar workshops will be facilitated at library conferences, we acknowledge that many library staff are unable to attend those conferences. Therefore, making the workshops available regionally provides an additional means of reaching library staff we might not otherwise reach.

Finally, the Buffalo & Erie County Public Library (B&ECPL) system contributes value as a research partner because of the extreme diversity in the populations that it serves, both the city of Buffalo and Erie county. According to the most recent U.S. Census data, Buffalo's population is 258,612 with 36% identifying as African American and 11% Latinx, with 31% of the total population in poverty. Combined, the minority population is larger than that of the white population in the city (https://www.census.gov/quickfacts/fact/table/buffalocitynewyork/PST045217). Erie County, with a population of over 900,000, is 80% white with only 14% of the total population in poverty (https://www.census.gov/quickfacts/fact/table/eriecountynewyork/PST045216). In addition, Erie county has a significant amount of land devoted to agriculture (http://www2.erie.gov/environment/sites/www2.erie.gov.environment/files/uploads/AgMap_AgDistricts_Map.pdf). Because B&ECPL serves significant numbers of urban, rural, minority populations who also vary according socio-economic status, their Makerspaces must also serve a diverse range of patrons. Their inclusion as a research partner will enable, even require, that the needs of diverse learners be at the core of all research.

National Impact
The *ALLMs* project will develop a suite of valid and reliable assessment tools for identifying, documenting and evaluating learners' engagement in making as an informal learning process. Through this work, *ALLMs* will enable researchers, evaluators, and practitioners of making in libraries to empirically measure and evaluate the learning of their patrons engaged in making spaces and activities. This effort directly aligns with the IMLS Strategic Plan, released this year, in both supporting lifelong learning as well as building capacity of library professionals. To do this, the project seeks to train and develop library professionals in the creation

and administration of formative and summative assessments for learning, as well as in the use of such evaluation tools for reflective practice and design. This project seeks to develop library professionals' understanding of, interest and confidence in the identification and assessment of learning through making, as well as in their ability to design to support rich informal learning experiences.
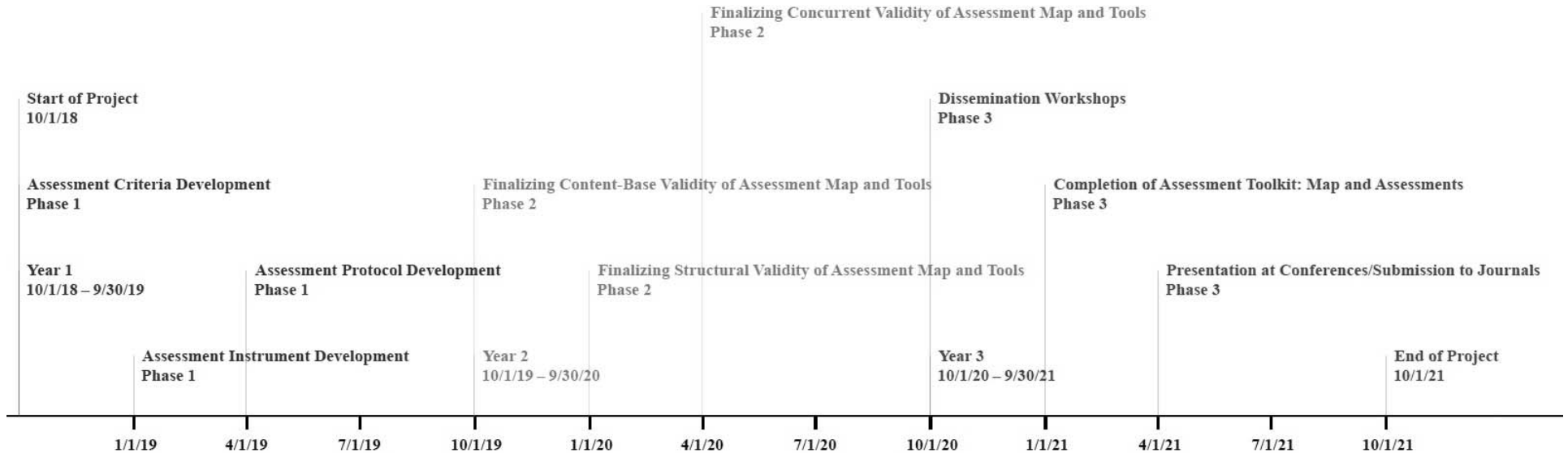
As *ALLMs* tools will be created collaboratively with researchers and practitioners, they will necessarily reflect the needs and priorities of library professionals, and the unique learning context of the library. This collaboration will work within and across library settings in Buffalo and Madison to address the range of learning contexts and audiences these sites are designed to support (e.g. drop-in, family learning, school-age groups, afterschool, adult learners, etc.). Finally, this study will significantly advance a research-based understanding of the assessment of making as a learning process. The benefits of the project will be sustained through publication and field-wide communication of findings, and by enabling the field to use the observation tools. The project will provide resources and pedagogical supports for researchers, evaluators and practitioners to reliably use the tool for advancing theory, assessing impact, and improving design for learning.

We also note that all *ALLMs* developed tools will be released under a to a Creative Commons Attribution-ShareAlike license (CC BY-SA). This license will permit everyone to use the produced digital products in perpetuity. The license will also let anyone build upon the digital products built by *ALLMs*, even for commercial purposes, as long as credit is given to the *ALLMs* project (i.e., noted in the derivative works) and that the derivative works are licensed under identical terms. This is the same license used by Wikipedia, an educational resource that is widely used and free to all. This license was selected in that it will encourage educational use of the materials ongoing, at any scale, and without restriction of purpose. In this way, the national impact of the tools cannot be restricted by copyright issues that frequently restrict the dissemination of other educational materials.

Project Budget and Resources: This project was designed with the appropriate resources and capacity in mind, therefore time is given to both the collection and analysis of data for development and refinement of the evaluation and assessment tools, as well as for the creation and contribution of professional resources for the fields of research and practice. The financial resources are focused on ensuring that personnel are supported in the research efforts and that funds are allocated to ensure stable conditions for comparative tool development. Project partners have successful experience with collaborative, IMLS-supported projects and each maintain the capacity necessary to implement this endeavor.

ALLMs: Assessment for Learning in Library Makerspaces

Schedule of Completion

Finalizing Concurrent Validity of Assessment Map and Tools
Phase 2

Dissemination Workshops
Phase 3

Start of Project
10/1/18

Assessment Criteria Development
Phase 1

Finalizing Content-Base Validity of Assessment Map and Tools
Phase 2

Completion of Assessment Toolkit: Map and Assessments
Phase 3

Year 1
10/1/18 – 9/30/19

Assessment Protocol Development
Phase 1

Finalizing Structural Validity of Assessment Map and Tools
Phase 2

Presentation at Conferences/Submission to Journals
Phase 3

Assessment Instrument Development
Phase 1

Year 2
10/1/19 – 9/30/20

Year 3
10/1/20 – 9/30/21

End of Project
10/1/21

| 1/1/19 | 4/1/19 | 7/1/19 | 10/1/19 | 1/1/20 | 4/1/20 | 7/1/20 | 10/1/20 | 1/1/21 | 4/1/21 | 7/1/21 | 10/1/21 |

Each demarcation on the timeline, unless stated otherwise, represents start dates for each major activity in the ALLMs proposal narrative.

Colors represent the 3 Phases of the proposal (see ALLMS proposal narrative for more detail).

Estimated Completion Dates are one month into the beginning of the next major activity. For example, Assessment Criteria Development is schedule to begin with the start date of the proposal on 10/1/18 and be completed by 1/31/19 while Assessment Instrument Development is scheduled to begin on 1/1/19 and be completed 4/30/19.

DIGITAL PRODUCT FORM

Introduction

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded digital products (i.e., digital content, resources, assets, software, and datasets). The products you create with IMLS funding require careful stewardship to protect and enhance their value, and they should be freely and readily available for use and re-use by libraries, archives, museums, and the public. However, applying these principles to the development and management of digital products can be challenging. 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

> Please check here if you have reviewed Parts I, II, III, and IV below and you have determined that your proposal does NOT involve the creation of digital products (i.e., digital content, resources, assets, software, or datasets). You must still submit this Digital Product Form with your proposal even if you check this box, because this Digital Product Form is a Required Document.

If you ARE creating digital products, you must provide answers to the questions in Part I. In addition, you must also complete at least one of the subsequent sections. If you intend to create or collect digital content, resources, or assets, complete Part II. If you intend to develop software, complete Part III. If you intend to create a dataset, complete Part IV.

Part I: Intellectual Property Rights and Permissions

A.1 What will be the intellectual property status of the digital products (content, resources, assets, software, or datasets) you intend to create? Who will hold the copyright(s)? How will you explain property rights and permissions to potential users (for example, by assigning a non-restrictive license such as BSD, GNU, MIT, or Creative Commons to the product)? Explain and justify your licensing selections.

All digital products produced from the ALLMs project (e.g., assessment tools, training materials) will be openly licensed according to a **Creative Commons Attribution-ShareAlike license (CC BY-SA). This license will permit everyone to use the produced digital products in perpetuity.** The license will also let anyone build upon the digital products built by ALLMs, even for commercial purposes, as long as credit is given to the ALLMS project (i.e., noted in the derivative works) and that the derivative works are licensed under identical terms.
This license was selected in that it will encourage educational use of the materials without restriction of purpose. This is the same license used by Wikipedia, an educational resource that is widely used and free to all.

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.

All participating parties in the ALLMs project (the University at Buffalo - SUNY, the University of Wisconsin – Madison, the Buffalo and Erie County Public Library, and the Madison Public Library) agree that new digital products produced through ALLMs will be published under **CC BY-SA** and provided though organizations who elect to publish the products on their websites (e.g., the University at Buffalo's website).
Any new parties who wish to collaborate on the ALLMs project must accept that all resulting digital products will be published under a **CC BY-SA** license – this is conditional to any participation.

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.

There are no anticipated privacy concerns, no necessary permissions or rights, and no potential cultural sensitivities regarding the digital products created by the ALLMs project. While it is possible that some ALLMS generated, digital assessment tools could generate sensitive data when used in different learning contexts (e.g., names, ages), the storing or sharing of data is not part of the ALLMs project.

Part II: Projects Creating or Collecting Digital Content, Resources, or Assets

A. Creating or Collecting New 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 format you will use.

Assessment resources are the sole type of product created in the ALLMs project. This can include, but is not limited to: surveys, tests, observation protocols, self-assessment checklists, and log frameworks. In that this is a research project where a primary goal is to identify what assessment tools are needed for Makerspaces in Libraries, we cannot specify the quantity that will be generated throughout the duration of the project. However, we can state that a minimal number of products will be ten, one for each participating library from the prior list of examples.

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

All digital products will be generated by the collaborators on the ALLMs project. Equipment, software, and supplies are expected to be the same as they would be for any assessment research project and development. This includes but is not limited to standard office software (e.g., Microsoft Office, Adobe Acrobat) and survey software (e.g., Survey Monkey, Qualtrics).

A.3 List all the digital file formats (e.g., XML, TIFF, MPEG) you plan to use, along with the relevant information about the appropriate quality standards (e.g., resolution, sampling rate, or pixel dimensions).

All digital products will be formatted to standards that are compatible with the CC BY-SA license. This includes but is not limited to PDF, JPG, and HTML. For potential file formats, please see https://en.wikipedia.org/wiki/List_of_open_formats

B. Workflow and Asset Maintenance/Preservation

B.1 Describe your quality control plan (i.e., how you will monitor and evaluate your workflow and products).

Because of the limited scope of the project, we do not expect significant quality control challenges. The PI, Dr. Abramovich, will serve as the final inspector on all digital products and determine when a product is mature enough for redistribution outside of the direct ALLMs collaborators.

B.2 Describe your plan for preserving and maintaining digital assets during and after the award period of performance. Your plan may 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).

Both during and after the completion of the ALLMs project, all generated digital products will be available on the University at Buffalo Open Education Research Lab's website - https://ed.buffalo.edu/research/centers/open-

ed.html. In addition, because all generated products will be CC BY-SA licensed, all products can be copied and served through any medium. This includes the websites of all ALLMs collaborators as well as any other organization who wishes to share the materials (with or without modification). Finally, digital products will also be shared in 3rd party repositories that share openly licensed material such as OER Commons and MERLOT.

C. Metadata

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

All metadata will be provided by the authors of the digital products, the ALLMs collaborators. Metadata standards will match the repository where the resources is stored. In the case of the University at Buffalo Open Education Research Lab's website, digital products will the Learning Resource Meta-data Specification (a derivation of Dublin Core) - http://www.imsglobal.org/metadata/index.html

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

Both during and after the completion of the ALLMs project, preservation and maintenance of the original digital products will be the responsibility of the PI. However, given that all products will be CC BY-SA licensed, an aim of ALLMs is to have interested librarians and other stakeholders create derivative works based on the digital products, updating the metadata when necessary.

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).

In addition to generation of metadata as described in section C.1, the ALLMs collaborators will promote the use of ALLMs digital products through conference presentation, regional workshops, distribution of printed materials by request, and participation in the relevant, online national forums (e.g., email distribution lists, discussion boards).

D. 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).

As referenced in B.2, all ALLMs digital products will be available on the University at Buffalo Open Education Research Lab's website - https://ed.buffalo.edu/research/centers/open-ed.html. In addition, because all generated products will be CC BY-SA licensed, all products can be copied and served through any medium. This includes the websites of all ALLMs collaborators as well as any other organization who wishes to share the materials (with or without modification). Finally, digital products will also be shared in 3rd party repositories that share openly licensed material such as OER Commons and MERLOT.

D.2 Provide the name(s) and URL(s) (Uniform Resource Locator) for any examples of previous digital content, resources, or assets your organization has created.

This is a new collaboration between the University at Buffalo - SUNY, the University of Wisconsin – Madison, the Buffalo and Erie County Public Library, and the Madison Public Library. As such, there are no prior examples of collaborative generated digital assessment resources. However, each organization has vast

experience in both creating and sharing resources.

Part III. Projects Developing Software

A. 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 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

B. Technical Information

B.1 List the programming languages, platforms, 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) and URL(s) for examples of any previous software your organization has created.

Not applicable for this project

C. Access and Use

C.1 We expect applicants seeking federal funds for software to develop and release these products under open-source licenses to maximize access and promote reuse. What ownership rights will your organization assert over the software you intend to create, and what conditions will you impose on its access and use? Identify and explain the license under which you will release source code for the software you develop (e.g., BSD, GNU, or MIT software licenses). 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.

Not applicable for this project

C.2 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.3 Identify where you will deposit the source code for the software you intend to develop:

Not applicable for this project

Part IV: Projects Creating Datasets

A.1 Identify the type of data you plan to collect or generate, and the purpose or intended use to which you expect it to be put. Describe the method(s) you will use and the approximate dates or intervals at which you will collect or generate it.

Not applicable for this project

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?

Not applicable for this project

A.3 Will you collect any personally identifiable information (PII), confidential information (e.g., trade secrets), or proprietary information? If so, detail the specific steps you will take to protect such information while you prepare the data files for public release (e.g., data anonymization, data suppression PII, or synthetic data).

Not applicable for this project

A.4 If you will collect additional documentation, such as consent agreements, along with the data, describe plans for preserving the documentation and ensuring that its relationship to the collected data is maintained.

Not applicable for this project

A.5 What methods will you use to collect or generate the data? Provide details about any technical requirements or dependencies that would be necessary for understanding, retrieving, displaying, or processing the dataset(s).

Not applicable for this project

A.6 What documentation (e.g., data documentation, codebooks) will you capture or create along with the dataset(s)? Where will the documentation be stored and in what format(s)? How will you permanently associate and manage the documentation with the dataset(s) it describes?

Not applicable for this project

A.7 What is your plan for archiving, managing, and disseminating data after the completion of the award-funded project?

Not applicable for this project

A.8 Identify where you will deposit the dataset(s):

Not applicable for this project

A.9 When and how frequently will you review this data management plan? How will the implementation be monitored?

Not applicable for this project