

## Abstract

The University of Texas at Arlington (UTA) Libraries, in partnership with University of Nevada, Reno (UNR), and University of Massachusetts Amherst (UMA), libraries, requests \$249,886.00 over a three-year period to build upon the Planning Grant funded by IMLS in 2017. The findings from the planning grant indicated that librarians and makerspace staff need support to feel empowered as faculty's curricular partners. Additionally, faculty desired tools for assessment that would assist them in evaluating student learning.

This Project Grant will focus on preparing librarians to collaborate with faculty for curriculum design and makerspace integration. UTA and its partners will scale up the work from the Planning Grant to 1) evaluate revisions to maker competencies based on the results of the Planning Grant pilot; 2) establish standardized assessment tools for measuring the impact of academic library makerspaces on student learning outcomes; and 3) create an Immersion program for librarians and makerspace staff to become curriculum design and assessment leaders within the academic library makerspace community.

Phase I of this project will begin September 2019 with the creation of customizable rubrics for the competencies, dispositions, and values articulated in the "List of Maker Competencies." During this phase, we will test these beta rubrics as well as the revised competencies generated by the Planning Grant via case studies in two courses at each of 10 colleges/universities, including UTA, UNR, and UMA. After evaluation of the case studies, we will produce standardized assessment tools for measuring the impact of academic library makerspaces on student learning outcomes.

During Phase II, grant personnel will create curricula for and host the first of two five-day Immersion programs intended to prepare librarians and makerspace staff to integrate making into courses. Based on feedback from attendees at the first Immersion program, Phase III will result in revised Immersion curricula and an online iteration of the Immersion program that will be open and freely available.

Although there is broad applicability for maker-based competencies across the domain of education, our primary audience for this project is academic librarians, library makerspace staff, and subject faculty. The revised competencies provide a framework for assessment of student learning that results from the integration of making and design thinking into curricula across diverse institutions. Our intent in Phase I is to test these revised competencies, along with newly created beta rubrics, in a diverse cross-section of academic libraries, including colleges and universities with different campus sizes, student body demographics, educational missions, and makerspaces of different sizes, equipment offerings, and levels of establishment. We will intentionally include faculty teaching in non-STEM disciplines. Phases II and III will also focus on recruiting diverse populations from diverse academic libraries and institutions to participate in both the in-person and online Immersion programs.

The Immersion programs outlined above will empower academic librarians to engage meaningfully with faculty in the design of detailed assignments that foster student growth via experiential learning and hands-on problem-solving. Librarians, makerspace staff, and subject faculty who participate in the Immersion workshops will establish, enrich, and/or redefine relationships that transcend this grant project and the specific courses conducted as part of it. Our hope is that these working relationships between faculty of different disciplines and librarians will lead to ongoing collaborative opportunities for curriculum co-development and learning assessment between Immersion participants.

# Maker Immersion: Developing Curriculum Design and Assessment Skills for Academic Makerspace Course Integration

## Statement of National Need

This Project Grant, if funded, will be a continuation of the Maker Literacies work completed as part of the IMLS National Leadership Planning Grant, Maker Competencies and the Undergraduate Curriculum (LG-97-17-0010-17, see Supportingdoc1.pdf). As discussed later in this document, the findings from the Planning Grant indicated that librarians and makerspace staff need support to feel empowered as faculty's curricular partners. Additionally, faculty desired tools for assessment that would assist them in evaluating student learning. The following proposal includes a review of the literature (see Supportingdoc11.pdf) that indicates similar findings in other settings, and a plan to address faculty needs and empower librarians and library makerspace staff as teachers of maker-based curricula.

## Giving Librarians Competency- and Confidence-Building Opportunities

To expand the Maker Literacies program and increase its impact, special attention must be placed on increasing librarians' capacity to collaborate with faculty on curriculum design for makerspace-course integration. As noted by Carroll & Klipfel (2019), the ability to teach well is not a naturally occurring gift, but rather a skill that has been developed, practiced, and honed; however, very few librarians are taught these skills in library school. By combining foundational knowledge of instruction design with action research, librarians can develop and improve their competencies in the realm of maker-based curriculum design.

Project Connect's Future Ready Framework (2015) is a program that aims to develop and promote librarian leadership by training librarians to collaborate with educators to integrate information literacy and other innovative practices into school work, and to have them work side-by-side with teachers to plan and deliver instruction, and to assess and evaluate the instruction. However, its specified audience is school and public librarians, not academic librarians. Further, while the emphasis is on digital literacy and curriculum development, they do not address maker literacies.

## Helping Librarians Develop, Implement, and Evaluate Replicable Academic Library Makerspace Curricula

Hands-on experiential learning opportunities in academic library makerspaces can be scaffolded into university curriculum to cultivate innovation, collaboration, critical thinking, and research skills. While several makerspace-course integration programs have emerged since our work began in 2016, none are as comprehensive (covering the entire lifecycle of curriculum design and integration through planning, delivery, and assessment) or as large (over 750 students, enrolled in 37 unique courses spread across five campuses, representing 13 disciplines) as what University of Texas at Arlington and its partners have achieved.

The most similar program to our work that we could identify was a National Science Foundation-funded project through Carnegie Mellon University (2018), MakeSchools. Their website hosts a directory of U.S. universities with makerspaces and maker education programs. While their reach across national universities is broader than our pilot program was, only a small subset of universities represented there have begun makerspace-course integration, and even fewer have submitted their curricula. Perhaps most importantly, this work did not consider the unique role of academic libraries in the makerspace domain, and it appears their

website is no longer being updated. Our program will continually develop new library leaders across a growing range of institutional partners and make new curricula available, using Creative Commons licensing, on our project website.

### **Evaluating How Makerspaces Impact Learning Across Disciplines**

As makerspace-course integration programs continue to appear, methods for evaluating how makerspaces impact student learning remain underdeveloped (Rosenbaum & Hartmann, 2017). As Koh & Abbas (2015) remark, the current literature focuses mainly on 1) history and models of makerspaces; 2) case studies or informal reports of how specific makerspaces were founded; 3) advice and resources for how to start a makerspace; 4) suggested technology and sample projects; and 5) issues related to funding, staffing and programming. Fortunately, some studies on measuring impact, student engagement, and learning outcomes are beginning to emerge. The most notable of these are included in the following literature review. Combining best practices presently emerging from the literature with our own expertise in program assessment and evaluation, we will develop beta rubrics, refine our pre- and post-self-evaluation surveys, and create other tools for measuring our impact on student learning across multiple disciplines.

### **Literature Review**

Hira, Joslyn & Hynes (2014) provide a concise and current review of the history of makerspaces in education, theoretical foundations, implications for pedagogy, and relevance of makerspaces to national science standards. While our project is outside the scope of the Hira review, it may be useful for gaining some foundational understanding. Andrews (2017) provides an exhaustive literature review on the state of the art in “Making Literacies,” and Rosenbaum & Hartmann (2017) provide a meta-analysis that distills recent literature on educational makerspaces into discrete areas of research.

Since the early stages of our work in 2016, several other makerspace-course integration programs have begun to emerge. It’s worthwhile to note that none of the following studies, nor any others, take into regard the unique position of academic library makerspaces. From what we could gather, all of these studies come from non-library university makerspaces (plus one example of a K-12 makerspace-course integration study). They also focus primarily on STEM curriculum, while we are intentionally recruiting collaborations with the arts and humanities in addition to STEM courses.

The largest and most widely published studies that we found in the literature are from Morocz et al. (2015, 2016) and Hilton, Tomko, Newstetter, Nagel, & Linsey (2018) who are conducting a four-year longitudinal study of how makerspaces influence at-risk student retention, impact students’ idea generation abilities and design self-efficacy, and positively influence females and minorities to broaden their participation in engineering. At the conclusion of the first year of the study, using a validated instrument for engineering design self-efficacy (Carberry, Lee, & Ohland, 2010), the researchers found that students with higher participation in their makerspace were more motivated and less anxious to perform engineering design related tasks. This early phase of the study consisted of 498 first-year undergraduate engineering students.

Nagel, Ludwig, & Lewis (2017) found that the multidisciplinary experience and use of maker technologies in a Community Health Innovation course at James Madison University enhanced student learning and engagement fostered teamwork and interdisciplinary skills, and increased student’s ability to innovate. This study involved 48 engineering, biology and pre-nursing students (24 students per semester for two semesters). The researchers used objective assessment data for course measures of student learning. The desired level of

attainment was met (or was a near miss) for all but one of their course learning outcomes: students underperformed in the category of ethical, legal, and practical implications of applying novel technologies. Learning outcomes for other categories, such as being able to describe the innovation process, far exceeded instructors' expectations.

Regarding the significance of makerspaces for engineering students, a University of Ottawa study reports an increase in confidence in communication and teamwork skills (80%), engineering and problem-solving skills (60%), and design skills (90%). Seventy-five percent reported that the makerspace helped them finalize their design projects by demonstrating limitations/restrictions of manufacturing methods, and by offering access to equipment, tools, and guidance (Galaleldin, 2017). This study relied on a survey of only 28 self-selected users of the L'Abbe makerspace who identified as engineering majors.

Saorín, Melian-Díaz, Bonnet, Carbonell Carrera, Meier, & De La Torre-Cantero (2017), using pre- and post- Abreaction Tests for Evaluation of Creativity, found that integration of 3D scanning, 3D modeling software, and 3D printing into a first-year engineering graphics course improved students' creative competence. This study analyzed the work of 44 students and focused on creative competency. Our work does not use Abreaction Tests for Evaluation of Creativity, but we are developing our own pre- and post- system for gauging 15 separate competencies, many of which would be considered "creative competencies."

Finally, Blikstein, Kabayadondo, Martin, & Fields (2017) are similarly engaged in research surrounding K-12 makerspace-course integration, integrating what they call "Exploration and Fabrication Technologies" (EFTs) into school curriculum and developing a statistically validated instrument for measuring skills attainment. While Blikstein et al. focus on technology literacy among K-12 students, our program focuses on interdisciplinary, transferable competencies among college undergraduates.

These studies are encouraging for our work, and demonstrate the need for more research into the assessment of makerspace impact on learning. We hope to add to this discussion through the development of competency rubrics and will expand the scope and number of students impacted by further focusing on preparing librarians and library makerspace staff to function as collaborators and co-teachers in maker or experiential learning environments for any subject discipline.

### **Expansion of Ongoing Maker Literacies Project**

As part of the 2017 IMLS National Leadership Planning Grant, Maker Competencies and the Undergraduate Curriculum, University of Texas Arlington Libraries (UTA), in partnership with University of Nevada Reno (UNR), Boise State University (BSU), University of Massachusetts Amherst (UMA), and University of North Carolina (UNC) Chapel Hill libraries, tested and revised a set of transferable skill-based competencies and corresponding student self-assessments. These materials, along with corresponding lesson plans, were made available via a newly created [Maker Literacies](#) website (see Supportingdoc2.pdf). A key takeaway from the Planning Grant was that librarians did not feel comfortable or knowledgeable enough to fully partner with faculty through the course integration and assessment process. Additionally, although faculty universally felt that their students greatly benefitted from the integration of making into their courses, several of them wanted tools that would assist them to better evaluate what students had specifically learned. To address these needs, and increase the impact of academic library makerspaces on curriculum, our focus in this Project Grant will be to build out these assessment tools and to create a platform to empower librarians and library makerspace staff to collaborate with subject faculty for curriculum design and makerspace integration. This

project will also create a cohort network of librarians and library makerspace staff who are engaged in maker-based experiential learning. This cohort can continue to support and empower each other and function as change agents at their institutions. This directly correlates to IMLS's strategic goals to promote lifelong learning and build capacity, and sits in the project category Lifelong Learning. To this end, the Project Grant will fund scaling up of this work by 1) evaluating revisions to the competencies based on the results of the Planning Grant pilot; 2) establishing standardized assessment tools for measuring the impact of academic library makerspaces on student learning outcomes; and 3) create an Immersion program for librarians and makerspace staff to become curriculum design and assessment leaders within the academic library makerspace community.

---

## Project Design

The overarching goal for this Project Grant is to increase the intentional integration of making and transdisciplinary skills into undergraduate curricula. To this end, this project will be comprised of three phases, the outcomes of which will be 1) tested and revised tools for curricular integration of making, and 2) a sustainable model for empowering cohort networks of librarians and library makerspace staff to teach and assess learning in makerspaces.

### Project Personnel

This project will be managed and administered by librarians and library makerspace staff from UTA, UNR, and UMA. (We are deeply appreciative of the work BSU and UNC dedicated towards this research during the Planning Grant. These institutions are unable to participate in the Project Grant due to personnel limitations).

**Gretchen Trkay**, Department Head for Experiential Learning & Undergraduate Success, UTA Libraries (Co-PI). Ms. Trkay will serve as the co-primary investigator for this grant and will be responsible for all planning, managing, teaching and reporting required, with an emphasis on developing Immersion curricula.

**Katie Musick Peery**, Director of UTA FabLab, UTA Libraries (Co-PI). Ms. Peery will serve as the co-primary investigator for this grant and will be responsible for all planning, managing, teaching and reporting required, with an emphasis on overseeing grant logistics.

**Morgan Chivers**, FabLab Librarian and Artist-in-Residence, UTA Libraries. Mr. Chivers will assist with selecting additional case study sites and courses; administering the case studies; creating and revising competency rubrics and feedback forms; determining Immersion site logistics; marketing and recruitment for Immersion; developing, teaching, and revising Immersion curricula and assessments; and developing a sustainability model for Immersion.

**Sarah Hutton**, Head of Undergraduate Teaching & Learning Services, University of Massachusetts Amherst. Ms. Hutton will serve as a partner librarian at UMA and will assist with coordinating IRB applications; determining Immersion site logistics; developing the Immersion program application and scholarship criteria; marketing and recruitment for Immersion; and developing, teaching, and revising Immersion curricula and assessments.

**Tara Radniecki**, Makerspace Director and Engineering Librarian, University of Nevada, Reno. Ms. Radniecki will serve as a partner librarian at UNR and will assist with selecting additional case study sites; creating and revising competency rubrics; developing the Immersion program application and scholarship criteria; and marketing and recruitment for Immersion.

**Martin Wallace**, Maker Literacies and Engineering Liaison Librarian, UTA Libraries. Mr. Wallace will assist with selecting case study site courses; administering case studies; creating and revising competency rubrics and self-assessments; populating the Maker Literacies website; developing, teaching, and revising Immersion curricula; and final reporting. He will also oversee the data analysis and the Data Analysis GRA.

**Graduate Research Assistant (GRA), Data Analysis**, UTA Libraries. To be hired, this GRA will organize, clean, analyze, and visualize the data collected through pre- and post-assessments, feedback forms, and other surveys and will create web-based access to that data.

**Graduate Research Assistant (GRA), Web Development**, UTA Libraries. To be hired, this GRA will design the architecture for and import content to the online platform for web-based Immersion. They will also assist with adding additional curriculum and content to the Maker Literacies website.

### **Phase I: Case Studies and Testing of Competency Rubrics**

Phase I of this project will begin September 2019 with the creation of customizable rubrics (see Supportingdoc3.pdf and Supportingdoc4.pdf) for the competencies, dispositions, and values articulated in the “List of Maker Competencies” (see Supportingdoc5.pdf). During this phase, we will test these beta rubrics as well as the revised competencies generated by the Planning Grant via case studies in two courses at each of 10 colleges/universities, including UTA, UNR, and UMA. Feedback from participants will be used to revise and improve the beta rubrics.

As during the previous Planning Grant, when selecting partners, we will look at schools large and small, geographically diverse, and with varying student demographics in order to represent a broad cross-section of academic library makerspaces nationally, including smaller universities, community colleges, tribal colleges, historically black colleges and universities, and colleges emphasizing liberal arts. UTA is a large urban university with the status of being a Hispanic-Serving Institution and is ranked the fifth-most ethnically diverse campus in the U.S. by *U.S. News & World Report* (2019). UNR is a mid-sized land-grant institution. UMA is a large, land-grant university that is the flagship of the University of Massachusetts system. We will also seek to include partners from academic libraries with different makerspace sizes and capabilities. We will use the evaluation grid created for our previous Planning Grant to identify partner sites (see Supportingdoc6.pdf), and leverage the relationships we’ve garnered with other academic library makerspaces through sharing that work to identify new potential case study institutions. We will rank interested parties based on their 1) strategies for integrating their makerspaces into undergraduate course work, 2) expected goals and outcomes, 3) knowledge and expertise related to measuring student learning and 4) potential buy-in from subject faculty. Based on these criteria, we will select seven new institutions by October 2019 for participation in the case studies.

Once selected, librarians at the grant personnel’s universities and seven additional institutions will gain commitment from two subject faculty members each (20 total) to participate in spring 2020 case studies. When identifying prospective subject faculty for the pilot, we will look to include a wide range of disciplines, including fields not usually considered relevant in maker-based education such as social sciences and humanities, and faculty will need to agree to apply the beta rubrics created by grant personnel as part of their assessment of student work. These course selections will be finalized by December 2019.

Librarians and faculty at each institution will develop new or modify existing course assignments as needed to align the revised maker competencies with their course learning outcomes and to adapt the beta rubrics so that they are contextualized to the assignments, with the assistance of Trkay and Wallace. Peery, Radniecki, and

Chivers will offer strategies and best practices for successful makerspace-course integration. Partners will receive funds to purchase consumable materials for use in their assignments. Faculty at institutions other than UTA will receive monetary compensation for the consultation work required to evaluate and revise the beta rubrics. UTA faculty will select either materials or technology for the FabLab, the Libraries' technology lending program, or general circulation as compensation for their consultation work to evaluate and revise the beta rubrics. Chivers and Wallace will liaise to the case study partners to oversee and assist with the administration of these courses, while the librarians and/or makerspace staff at each institution will be responsible for facilitating the case studies, communicating with their faculty, and submitting periodic feedback to Peery and Trkay throughout the semester.

The case studies will launch in spring 2020, during which time we will test the beta rubrics to determine the feasibility of using these as direct assessments of student learning. Wallace will administer pre- and post-assessments to all students enrolled in the Maker Literacy courses, incorporating a feedback method to glean how making has impacted their learning. Through exit questionnaires and/or interviews with librarians and faculty, we will determine if the beta rubrics' language makes sense to those who would be evaluating student assignments, and we will solicit recommendations for revising the beta rubrics so that they are both usable and measure the related maker competency. Lesson plans and assessments will be added to the Maker Literacies web site for all case studies by June 2021.

This Project Grant will also fund data analysis consultation with UTA's Center for the Integration of Research, Teaching and Learning (CIRTL) during fall 2020 (see Supportingdoc7.pdf). This consultation will develop strategies for analysis and visualization of the data gathered during the case studies. Once a process is established, Wallace will hire and supervise a data-focused GRA to implement strategies that support continuous and sustainable ingestion, analysis, and visualization of maker-related student learning data.

## **Phase II: Creation, Dissemination, and Assessment of In-Person Immersion**

During Phase II, grant personnel will create curricula for and host the first of two five-day Immersion programs intended to prepare librarians and makerspace staff to integrate making into courses. Key personnel will begin planning for a summer 2021 Immersion during the summer of 2020. This process will include 1) locating facilities and determining dates for the Immersion program; 2) completing the Immersion curricula; 3) planning and coordinating event logistics; 4) developing a scholarship program, with selection criteria, for the event; and, 5) recruiting and registering attendees from diverse institutions and backgrounds. Peery will lead the logistical planning for the event, while Trkay will lead the development of program curricula.

A sub-group of four grant personnel will host and teach the in-person Immersion program at UTA for the inaugural year. For this, non-UTA immersion instructors will receive monetary compensation. UTA immersion instructors will not receive monetary compensation. The grant will also fund airfare and housing for the grant personnel who will be traveling in order to provide instruction during Immersion. All instruction, materials, and meals will be funded by the grant and provided to Immersion attendees free of charge. Attendees will be responsible for airfare and reasonably priced campus housing. To facilitate an attendee population representative of diverse institutions and backgrounds, we will provide airfare and housing scholarships for 20 attendees per iteration of the program.

In late June 2021, key personnel will host and teach the first Maker Literacies Immersion program, focused on teaching 75 academic librarians and library makerspace staff all that was learned during the Planning Grant

and Phase I of this grant. Our goal is to prepare more professionals, who are likely to be innovators or change agents at their colleges or universities, to partner with faculty to create maker-integrated curricula and measure student learning, and to increase the intentional integration of making and transdisciplinary skills into undergraduate curricula. Participants will learn about 1) developing maker-based learning outcomes that map to subject-based learning goals; 2) creating maker-based assignments; 3) managing instructional experiences in makerspaces; 4) integrating reflection into making (an essential element of experiential learning); and, 5) assessing student learning. The maker Immersion program will be modeled on the Association of College and Research Libraries' Information Literacy Immersion program and offer ample opportunities for both professional growth and empowerment as it relates to maker curricula and networking with fellow change agents. The choice of 75 attendees per iteration of the Immersion program will allow us to create four groups of 18 to 20. This smaller group size will encourage closer connections among attendees and facilitate active, experiential learning opportunities for all (see Supportingdoc8.pdf).

Assessment of the Immersion programs will be achieved via a reflective exercise on the last day of the program. To supplement this information, Wallace will administer an evaluation to all attendees and instructors to gather feedback on the programs' curricula and structure. This exit survey will include questions related to IMLS performance measures.

### **Phase III: Immersion Revision and Development of Online Platform**

Based on feedback from attendees at the first Immersion program, Phase III will result in revised Immersion curricula and an online iteration of the Immersion program that will be open and freely available.

Beginning in fall 2021, Chivers, Peery, Trkay, and Wallace will use feedback from the exit surveys to revise and improve both the in-person and online (discussed below) versions of the Maker Literacies Immersion program. At this same time, we will begin the planning process anew for the second iteration of in-person Immersion. Peery will continue to lead the logistical planning, while Trkay will continue to lead the curricular programming. The second in-person Immersion will take place in late June 2022. Again, all attendees will complete the exit survey. Feedback from attendees of both the in-person and online versions of the program will be used to once again review the curricula and develop a plan to sustain the program once the grant is complete.

As attendees begin to implement Maker Literacies curricula at their home institutions, the grant will also fund, through the work of a web development GRA, a mechanism for their curricula to become part of UTA Libraries' Maker Literacies web site. This GRA will report to UTA Libraries Marketing and Communications department, and will complete this work by May 2022. This site will function as a repository for maker-related curricula and assessments that are appropriate for undergraduate students.

In fall 2021, key grant personnel will also begin developing Immersion content for an online audience. This process will include 1) selecting an online platform that meets best practices for online teaching and learning; 2) determining teaching strategies that engage learners in an online environment; 3) creating mechanisms for online learners to communicate with grant personnel and each other in a way that is supportable and sustainable; 4) hiring and managing the web development GRA; and, 5) marketing the online Immersion program library and makerspace audiences. The web development GRA will begin researching platforms in fall 2020 and will continue developing mechanisms for adding lesson plans and maker content to the Maker Literacies site. Decisions about the platform, content, and functionality will be based on ensuring that the most

impactful aspects of the in-person Immersion program are translated into an online environment. Everyone that uses the online instructional platform will be encouraged to complete the exit survey.

### **Intended Audience**

Although there is broad applicability for maker-based competencies across the domain of education, our primary audience for this project is academic librarians, library makerspace staff, and subject faculty. The revised competencies provide a framework for the assessment of student learning that results from the integration of making and design thinking into curricula across diverse institutions. Our intent in Phase I is to test these revised competencies, along with newly created beta rubrics, in a diverse cross-section of academic libraries, including colleges and universities with different campus sizes, student body demographics, educational missions, and makerspaces of different sizes, equipment offerings, and levels of establishment. Phases II and III will also focus on recruiting diverse populations from diverse academic libraries and institutions to participate in both the in-person and online Immersion programs.

Secondary audiences for this content created as part of this Planning Grant include makerspace staff and teachers in K-12 and other educational environments and public libraries integrating making into their programming. Ultimately, undergraduate students from a wide cross-section of subject disciplines will be our audience, as they will be the ones benefiting most from competency acquisition gained in this program.

Our primary audience of academic librarians, library makerspace staff, and subject faculty will benefit from this Project Grant by gaining an understanding of how making and design thinking apply to their subject disciplines; growing their comfort and expertise with integrating makerspaces into their curricula; and learning more about curriculum design, mapping competencies to learning outcomes, and measuring student learning. A fringe benefit will be that librarians and subject faculty will collaborate in new and exciting ways that take seriously cross-disciplinary teamwork. Tenure-track librarians and subject faculty will be able to use this experience and any publications that result from it for their tenure review.

### **Performance Evaluation**

This Project Grant is designed to answer the following questions: 1) How well do rubrics function as a direct assessment of student learning of transdisciplinary skills? 2) How accurately do the beta rubrics represent the transdisciplinary skills librarians and subject faculty associate with specific maker competencies, dispositions, and values? 3) What revisions would partners suggest to improve the beta rubrics? and 4) What strategies can we employ to sustainably gather, analyze, visualize, and make accessible student learning data and the corresponding maker-integrated curricula and assessments?

To increase the teaching of transdisciplinary skills through intentional integration of making into the curricula, we must evaluate the following: 5) What is the optimal curricula and format for library and makerspace staff's professional development related to curricular integration of making? 6) How can this professional development be maintained and delivered in a sustainable fashion?

We will allow ample opportunities at all stages of the case studies for input, consensus building, and buy-in from all program participants, including key personnel, librarians, subject faculty, and makerspace staff. We will actively seek feedback about our beta rubrics from all stakeholders. We will seek feedback using regular communication with program participants, periodic reports from case study librarians, and through surveys from each librarian and faculty participant in accordance with IMLS Performance Measurement Goals. We will add additional questions to the evaluation survey that reflect our specific information needs. These questions,

along with the IMLS-mandated Performance Measures Statements will gather information that will assist us in answering the questions outlined above. Specifically, case study librarians and subject faculty will complete an exit survey or interview to provide feedback and suggestions for improving the beta rubrics. Immersion attendees will also be asked to provide comprehensive written feedback with suggestions for how to improve the programming. In addition to the exit survey, in fall 2019 we will create student feedback mechanisms. Throughout the Planning Grant and this grant, if funded, we have gathered librarian, makerspace staff, and faculty input about the competencies, assessments, and curricula. Student feedback mechanisms, most likely added to the pre- and post-self-assessment surveys, will provide insights from the student perspective about how making is integrated into their learning experiences.

### **Risks**

We have identified the following risks in pursuing this Planning Grant. First, we may not have interest from a diverse group of institutions that also meet our criteria. Additionally, there is the risk of not getting adequate follow-through from participating librarians and subject faculty. While subject faculty may be eager to participate in the program at first, it is possible that once their course begins they may find it difficult to track, document, and report their progress since this program adds an additional level of reporting to already burdensome instruction processes. Key personnel will mitigate this risk by keeping reporting requirements to a minimum and by maintaining regular communication with project participants. Finally, we may be unable to recruit 150 attendees over a two-year period to attend the in-person Immersion programs, especially in the second year when there will be a free, online version.

### **Sharing**

As has been the case with the Planning Grant results, the grant key personnel will share the results of this Project Grant via conferences, publications, the UTA Libraries' Maker Literacies website, and informal channels such as blogs and professional networks. Specifically, we plan to publish white papers in the *International Journal of Academic Makerspaces and Making (IJAMM)* on the ongoing results of this work each year, and subsequently present those papers at the *International Symposium of Academic Makerspaces (ISAM)*. We will also submit a proposal for an ACRL preconference, and encourage faculty participants to seek out discipline-specific journals and conferences. Additionally, the in-person and online Immersion programs are inherently a sharing mechanism for the results of this Project Grant.

---

## **Diversity Plan in Brief**

There are many definitions of diversity, and we believe that diversity and inclusion call for valuing and respecting differences. We want to recognize a wide range of voices and perspectives in our project, and our goal is to make this intent apparent at every stage of our work. We have developed plans to achieve three distinct goals, listed below; with the full strategy listed in the Diversity Plan (see Supportingdoc9.pdf):

### **Focus on Universal Instructional Design**

Universal Design (UD) improves access and learning outcomes for all, and should hold a central focus during the development of in-person and online curriculum. Our Grant and Case Study personnel will collaborate with campus partners to achieve this goal.

### **Establish Inclusive Immersion Opportunities**

For the Immersion programs, our goal is to have a group of participants ranging in gender identity, disciplinary background, race, socioeconomic status, time/experience in academic libraries, and more. Our Recruitment Strategy will allow us to build Immersion programs fit to support multiple voices and perspectives, in a safe and inclusive space (see Supportingdoc10.pdf).

### **Foster a Diverse Community of Practice**

We intend to establish a cohort that can help us in shaping future programming and learner community development in an inclusive way. We plan to extend the impact of the week of Immersion to maintain an ongoing discussion between Immersion cohort members, providing individuals with opportunities for further professional development.

---

## **National Impact**

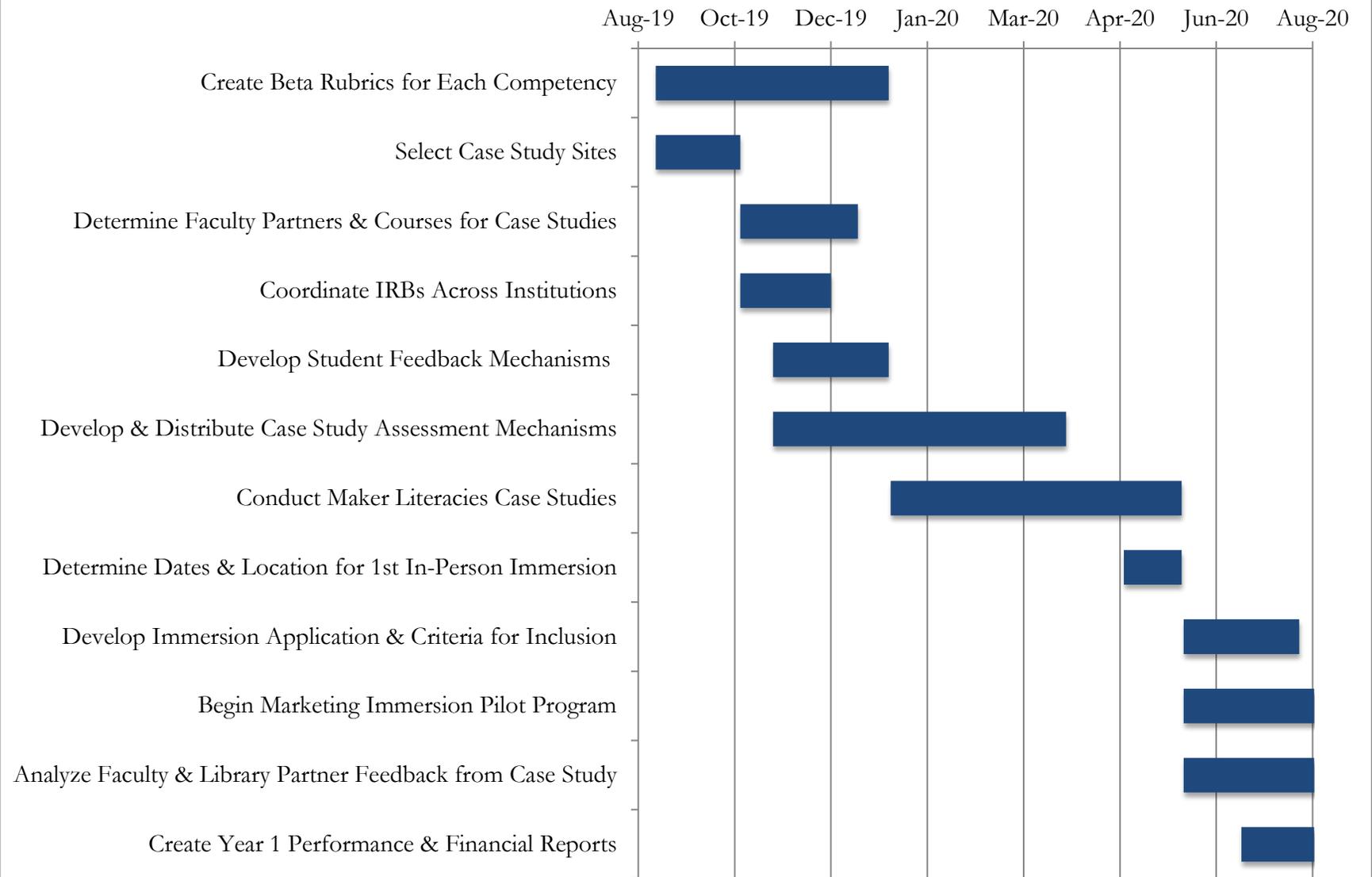
The Immersion programs outlined above will empower academic librarians to engage meaningfully with faculty in the design of detailed assignments that foster student growth via experiential learning and hands-on problem-solving. The transferable skills cultivated through these courses will better prepare participating students to confidently and competently navigate future academic, employment, and life experiences.

The increased capacity of academic librarians to assist faculty with curriculum development will have ramifications for many more courses than those included in the grant-funded project. Librarians, makerspace staff, and subject faculty who participate in the Immersion programs will establish, enrich, and/or redefine relationships that transcend this grant project and the specific courses conducted as part of it. Our hope is that these working relationships between faculty of different disciplines and librarians will lead to ongoing collaborative opportunities for curriculum co-development and learning assessment between Immersion participants. Also, we hope that the demonstrated benefits of those academic alliances will manifest in broader cultural shifts at institutions in which academic librarians and library makerspace staff come to be seen not as campus resources to be used, but as full partners in the pedagogical life of the university.

Immersion participants will forge strategic collaborative relationships of inter-institutional colleagues, prompting publishing prospects that communally elevate the discourse between, for, and about academic library makerspaces. The shared interests and collective leveragability of expertise at the intersection of formal and informal applied learning environments will yield opportunities for problem solving, consensus-building, and dissemination of best-practices regarding makerspace management and dynamic curriculum design.

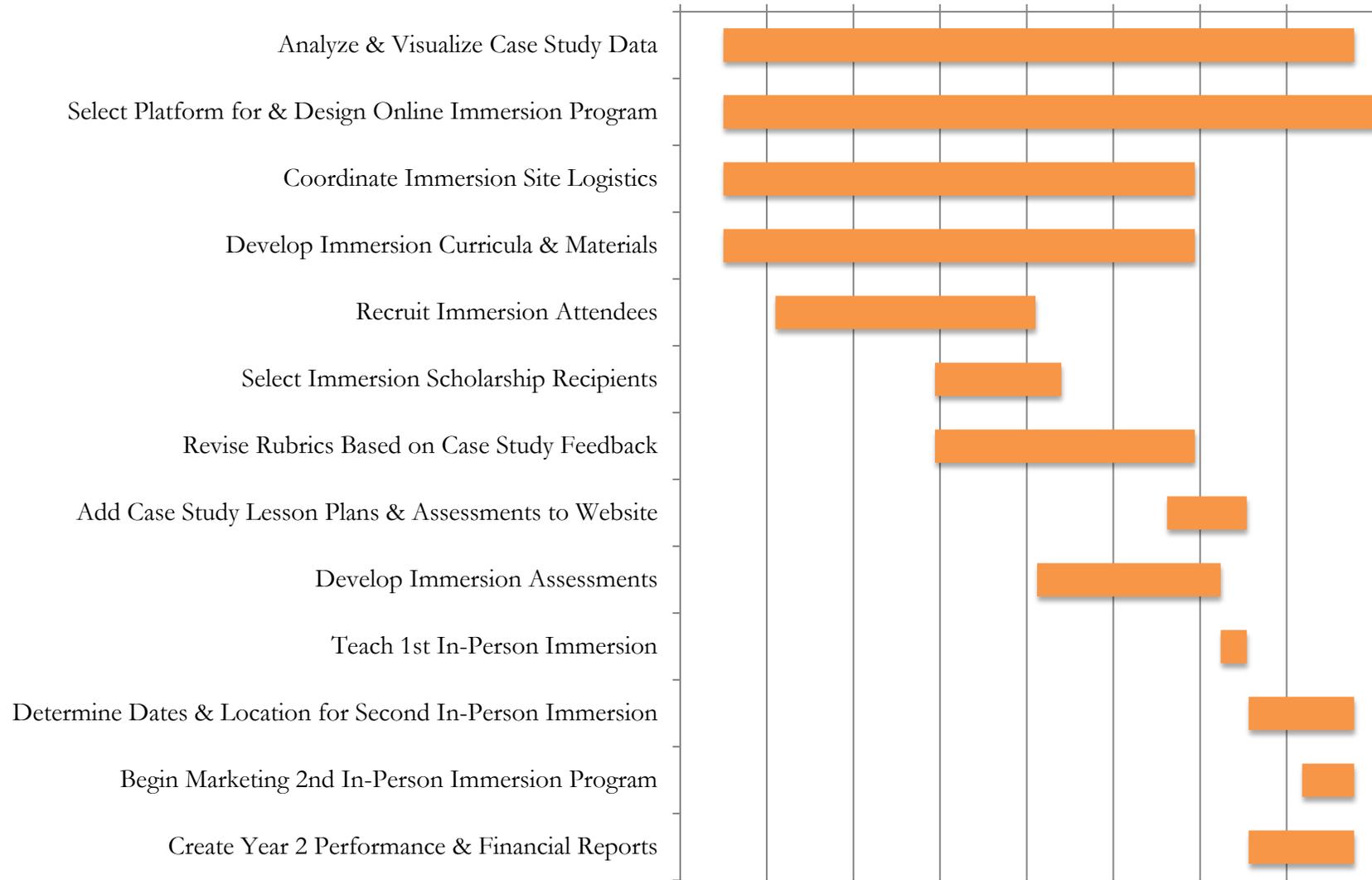
The development and continued hosting of the online and asynchronous workshop materials will facilitate ongoing, autodidactic, and scalable skill-building opportunities for all academic librarians, makerspace staff, and subject faculty. The Maker Literacies website will continue to provide access to freely available curricular materials under a Creative Commons license that can be adopted and adapted to the needs of learning situations across the spectrum, bringing relevant, replicable, and domain-specific curriculum to everyone.

## Schedule of Completion: Grant Year 1

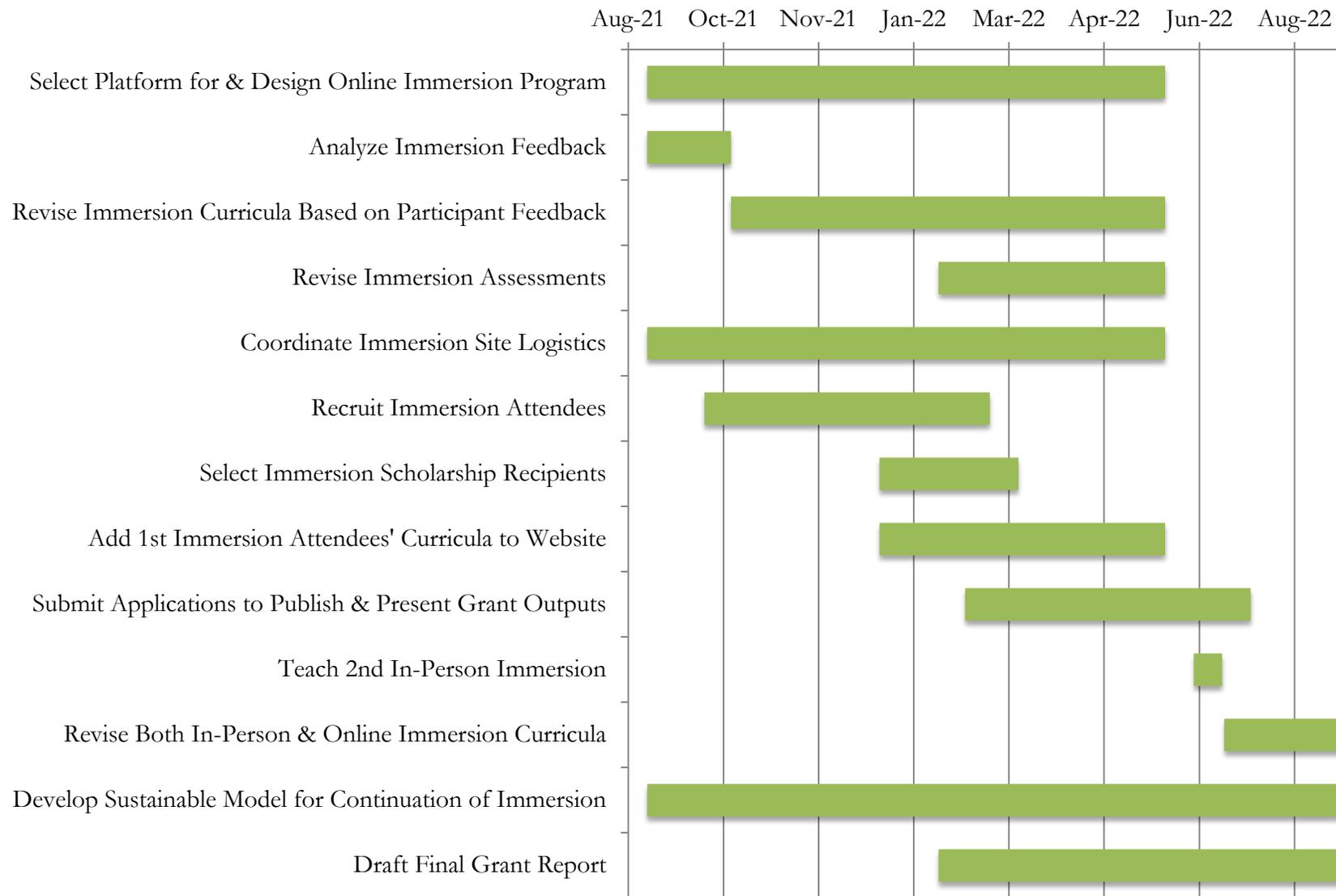


## Schedule of Completion: Grant Year 2

Aug-20 Sep-20 Nov-20 Jan-21 Feb-21 Apr-21 Jun-21 Jul-21 Sep-21



### Schedule of Completion: Grant Year 3





## DIGITAL PRODUCT FORM

### Introduction

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded digital products (e.g., 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. 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

All applications must include a Digital Product Form.

- 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.

**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.

**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.

## **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 the format(s) you will use.

**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.

**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).

**B. Workflow and Asset Maintenance/Preservation**

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

**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).

**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).

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

**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).

#### **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).

**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.

### **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.

**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.

**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.

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

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

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

**B.5** Provide the name(s) and URL(s) for examples of any previous software your organization has created.

### **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.

**C.2** Describe how you will make the software and source code available to the public and/or its intended users.

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

Name of publicly accessible source code repository:

URL:

## **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.

**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?

**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).

**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.

**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).

**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?

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

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

Name of repository:

URL:

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