

Project Justification

Middle Tennessee State University (MTSU) seeks \$549,560 IMLS National Leadership Grants for Libraries (NLGL) funding for a three-year applied research project (August 1, 2023 - July 31, 2026) titled **An Investigation of Virtual Reality Initiatives and Workforce Development Outcomes in Public Libraries** to investigate virtual reality career exploration and training initiatives in libraries and their role in yielding positive workforce outcomes (i.e. entry, re-entry or career transitions in the workforce) for users. This project aligns with NLGL Goal 2, Objective 2.1, given the focus on library programming that will increase access to workforce training for diverse members of economically distressed, at-risk, and transitioning communities by using virtual reality tools.

Overview of Project. This project has three objectives: (1) explore the association between virtual reality (VR) training and workforce outcomes, especially in economically distressed areas; (2) identify library features that facilitate or hinder patrons from receiving VR training across multiple library locations; and (3) develop a sustainable model for continuation and replication of this project. To achieve these objectives, we will partner with six public libraries across six counties in Tennessee - two economically distressed (Clay & Grundy), two at-risk (Fentress & Overton), and two neither at risk nor distressed (Cannon & White), to provide career development VR simulations associated with in-demand career sectors in those counties. Library partners in the Tennessee Regional Library System (TRLS) will be: (a) Clay County Public Library; (b) Altamont Public Library (*Grundy County*); (c) Fentress County Public Library; (d) Millard Oakley Public Library (*Overton County*); (e) Adams Memorial Library (*Cannon County*); and (f) White County Public Library. Libraries will be equipped with VR technology and trained to create and promote VR workforce development programming coupled with industry credentialing (OSHA 10-Hour General Industry) opportunities to patrons, including adults looking to make career transitions or enter/re-enter the workforce, veterans, immigrants and refugees, individuals with disabilities, and senior citizens at no cost to patrons. Throughout the project, work will be informed by an external advisory board with national library and workforce representation as the project team explores VR initiatives and workforce development outcomes in libraries. Project PIs have library, workforce, educational research, and STEM programming expertise.

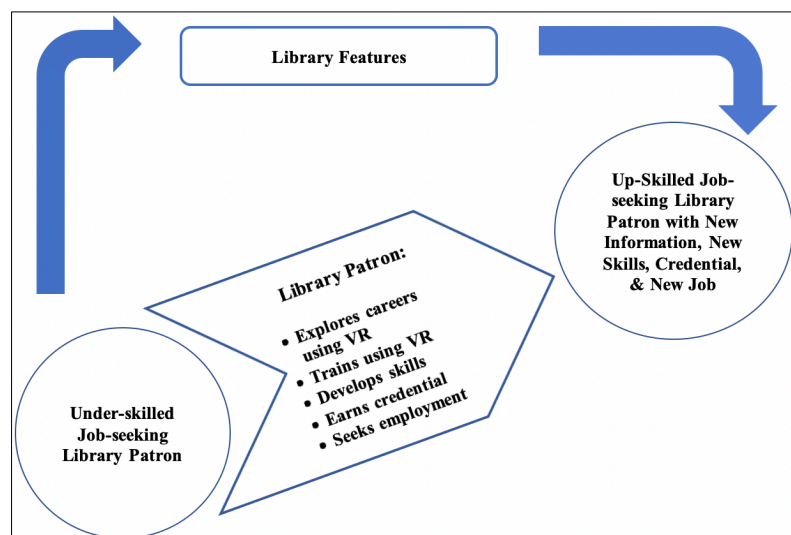


Figure 1. Theory of change illustrating how VR might support the upskilling of library patrons.

The theory of change in Figure 1 illustrates the learner (under-skilled job-seeking library patron), the learning outcome (up-skilled job-seeking library patron), and the approach that informs change (VR workforce training associated with industry credentials and career exploration). **We hypothesize that VR training and workforce outcomes (e.g., employment) are positively associated (illustrated by the upward slope in Figure 1) and that some library features (e.g., the seclusion of space) can hinder or facilitate patrons from receiving VR training.**

Description of Need. This project aims to address the current need for increased access to workforce development in Tennessee. The libraries participating in this project were selected through an iterative process. First, Tennessee Regional Library

System (TRLS) leadership met with the project team to review project objectives. Next, the project team collaborated with TRLS to design and distribute a survey to all libraries under TRLS leadership across the middle region of Tennessee. The survey asked interested libraries to provide average weekly patron usage, staffing capabilities, past and current workforce programming, existing industry partnerships, patron-available computers and WiFi access. Interested libraries were matched with county economic status (distressed, at-risk, transitioning, or competitive) and 2020 U.S. census demographic data that was used to determine comparability of potential libraries and patrons. Regional workforce boards aligned with interested libraries were then surveyed to determine workforce needs and gauge support for the project. The project team identified the six libraries best suited for the research design and informed TRLS leadership.

The identified need for the project is the lack of access to workforce development in Tennessee counties that are classified as economically distressed, at risk for becoming economically distressed, and economically transitional. These classifications are associated with a lack of skilled workers for high wage, high demand jobs and have higher rates of poverty and unemployment, and less access to training opportunities. As a result, there is a need to increase access to workforce development in these areas to improve economic conditions and job prospects for individuals.

Demographic data from the 2020 Census for the identified counties shows that the population is diverse with regards to age, race, ethnicity, socioeconomic status, ability and disability. This information is relevant for the proposed

project as it indicates that a broad range of individuals could benefit from increased access to workforce development. Additionally, the data shows that the population in these areas is more likely to have lower levels of educational attainment, which is consistent with the need for increased access to training and development opportunities. The project will focus on the greatest workforce needs in the geographic region, as identified by data from the Tennessee Department of Economic and Community Development and substantiated by regional workforce boards aligned with the participating counties (Upper Cumberland Workforce Board & Southeast Tennessee Workforce Board). The project's scope is limited to the six identified counties and will involve partnerships with public libraries in those areas.

Target Group. The target group for the project is under-skilled job-seeking library patrons. These individuals may lack access to the necessary resources to advance their careers, and as a result, experience limited opportunities for professional growth and financial stability. The project aims to address this issue by providing these individuals with the opportunity to complete simulations aligned with workforce needs in their geographic region and earn an industry credential paid by the project, not the patron. The project will focus on libraries located in economically distressed, at-risk, and transitioning locations which may be characterized by decreased access to quality education, limited job opportunities, and high levels of poverty. By targeting these libraries, the project aims to reach individuals who may benefit most from resources. Participants in the project will be diverse with regard to age, race, ethnicity, socioeconomic status, prior and current work experience, ability and disability, veteran status, and education level. The project aims to promote equity and inclusivity by providing resources to individuals who may have been previously excluded from these opportunities due to systemic barriers.

Participants may experience an improvement in their job prospects and financial stability as a result of completing simulations and obtaining the OSHA 10 credential. Just over one in four (27%) Americans visit libraries to attend a class, program, or lecture for adults (Perrin, 2016). Based on counts provided by TRLS libraries with which we are partnering on this project, the research team estimates 1,162 library patrons (27% of weekly patron visit counts) will be immediately and positively affected during this three-year project.

Beneficiaries. This project has the potential to benefit a range of individuals and communities. Certainly, the target group of beneficiaries are the under-skilled job-seeking library patrons who may lack access to the necessary resources to advance their careers. Beyond this target group, there are many other beneficiaries. **Employers** in the geographic regions of partnering libraries who have a shortage of skilled and qualified workers aligned with the VR simulations we will place in the libraries are also beneficiaries of this project. By providing training and certification opportunities, the project aims to fill the skills gap and increase the pool of qualified candidates available to these employers. This may result in greater economic development and growth for these communities. **Library administrators and staff** will also benefit from this project, as they will be more skilled with VR technology and workforce partnerships and programs. The project aims to develop or enhance collaborations between libraries and stakeholders such as workforce boards, employers, chambers of commerce, and educational institutions. This will provide the library staff with professional development opportunities and enable them to better serve their patrons. **Communities** where these libraries exist will also benefit from this project. Access to services provided by a skilled workforce will improve the local economy and increase community development. The project may transform how libraries are viewed and utilized in rural and suburban communities.

Theory, Scholarship, and Practice. Existing VR scholarship has utilized a variety of career development and learning theories, including Cognitive Load Theory (Frécon et al., 2018; Mei et al., 2019), Experiential Learning Theory (Chou et al., 2018; Huang et al., 2019; Jones et al., 2018), Self Determination Theory (Chen et al., 2020; Huang et al., 2021), Situated Learning Theory (Lee & Lee, 2017; Li et al., 2017; Liu et al., 2019), and Social Cognitive Theory (García-Villamisar et al., 2020; Ou et al., 2021; Sankaranarayanan et al., 2021). This project builds upon and complements VR scholarship grounded in Experiential Learning Theory. Experiential Learning Theory suggests that learning is achieved through the process of reflection and experimentation. VR-based training can provide learners with engaging and authentic contexts for learning, as well as opportunities for exploration, reflection, and experimentation (Kolb, 1984).

Existing Scholarship. Prior research has demonstrated VR training is superior to classroom training for workforce development in a variety of ways. First, VR training provides a realistic simulation of a particular scenario (Dyer et al., 2018), allowing trainees to explore the situation without any physical harm. According to Lucca and Giachetti (2017), VR simulations enhance the trainees' performance, as it provides a realistic environment and increases the trainees' confidence, ultimately improving their proficiency. Further, because VR training can be accessed from anywhere with trainees only requiring a VR headset and an internet connection, eliminates the need for specialized instructors, and trainees can learn at their own pace, VR can lead to significant training-related cost savings (Domingo et al., 2020). According to Shah et al. (2021), VR training provides an enhanced level of engagement compared to traditional classroom training because it is more interesting and engaging, which results in increased motivation and enthusiasm and leads to better learning outcomes. As VR training allows trainees to learn at their own pace, trainees' unique learning needs are met and they can focus on areas they find challenging (Chan et al., 2019). Additionally, VR technology can

provide real-time feedback, allowing trainees to understand their progress and identify areas they need to improve, which leads to better learning outcomes (Chan et al., 2019). Trainees learn in a simulated environment that mimics real-life situations and the interactive nature of VR technology increases the trainees' ability to recall the training, leading to better retention compared to traditional training (Brodersen et al., 2020). Finally, VR technology can provide a standardized and consistent learning experience, which can be delivered to all trainees, irrespective of location (Akçayır et al., 2017). With regard to libraries and VR, existing scholarship is very limited. Research about library usage of VR has only focused on academic library settings revealing that libraries are appropriate for hosting VR technology at universities (Ellern & Cruz, 2021), VR builds self-efficacy of undergraduate students (Lischer-Katz et al., 2018), students enjoy VR services at university libraries (Frost et al., 2020), academic librarians believe marginalized communities could benefit from VR but the success of VR programming depends on the recruitment and promotion strategies (Lee et al., 2020), and academic library lending of VR technology is best facilitated by collaborations with other academic units (Colegrove, 2018). **None of the existing research regarding libraries and VR has occurred in the context of public libraries.** While the bulk of library-based research occurs in academic libraries, Sørensen (2021) argues empirical evidence supporting the value of public libraries to a community is essential to sustain public library relevance.

Scholarship Gaps. While VR allows users to experience a digital environment as if they were physically present in it and has gained significant attention as a tool for workforce development, there is a dearth of research on the use of VR skills training. Li et al. (2020) reported a lack of research on the effectiveness of VR for job training, especially regarding learner outcomes (Kizilcec et al., 2015). Grubert and Kühnl (2019) identified a need for understanding the accessibility of VR training for widespread adoption. Huang et al. (2019) reported a limited understanding of VR can effectively be used for skill acquisition. Caballero et al. (2017) highlighted the need for research on the effectiveness of VR training for all users to address inclusivity and accessibility. While VR can be a highly immersive and engaging technology, it is important to understand how users perceive and interact with VR-based training and related credentialing (Cennamo et al., 2020). More research is needed on the user experience of VR for workforce development (Nogueira et al., 2019) and how to effectively design VR Programs (Anderson et al., 2019).

This project aims to address the gaps in research by investigating the use of VR for facilitating industry credentialing and employment. Addressing these gaps in research is critical to realizing the potential of VR for workforce development and industry credentialing, in general, and can inform current and future practice in libraries, specifically. Further, as Dyer et al. (2018) explained, “as the technology becomes more affordable and accessible, it is important to develop best practices for using VR in the library” (p. 498), which this project aims to do.

Current Practice. In 2010, the U.S. Department of Labor (USDOL) issued Training and Employment Notice (TEN) 50-9 to encourage collaborations between the workforce investment system and public libraries to meet career and employment needs and highlighted existing partnerships. The USDOL released a similar TEN in 2016 highlighting opportunities within the Workforce Innovation and Opportunity Act (WIOA) and IMLS has identified workforce development as a priority area (IMLS, n.d.). Public libraries are an ideal place for expanding access to technology and skills training through non-formal learning given their potential for reaching a large group of jobs seekers because of their reputation as trusted information sources, high volume of use and geographic distribution of facilities (Colegrove & Douglass-Westergard, 2021; Holcomb et al., 2019). VR has proven to be an effective and affordable non-formal learning solution for exposing job seekers to career opportunities and training aligned with industry credentials often required for employment (Kim et al., 2020; Le et al., 2015). Identifying factors and strategies that motivate a diverse population of job-seekers in a community to utilize library-based employment-related services is essential to training a skilled workforce and creating a pipeline for diverse populations to careers (Holcomb et al., 2019). Libraries have (a) provided workforce development programs for residents to access jobs (Mt. Auburn Associates, 2021); and (b) in recent years, incorporated VR as part of *smart library* technologies (Enis, 2018; Greene & Groenendyk, 2018). Interestingly, the incorporation of VR into library-based workforce development initiatives lacks wide-spread adoption and supporting empirical research (Suen et al., 2020).

Some libraries in the United States have adopted VR technology to offer innovative programs and services to their patrons for workforce training and industry credentialing. For example, the Public Library of Anniston-Calhoun County in Alabama (Public Library of Anniston-Calhoun County, 2021), the Orange County Library System in Florida (Orange County Library System, 2021), the Library of Michigan (Library of Michigan, 2021), and the Brooklyn Public Library in New York (Brooklyn Public Library, 2021), among others, use VR designed to help patrons gain new skills and credentials in a variety of fields. Another example is the Skokie Public Library in Illinois, which partnered with the local Chamber of Commerce to offer VR training modules for a variety of industries to help job seekers learn new skills and enhance their employability (Skokie Public Library, 2021). Perhaps the most robust example is Nevada’s Supporting and Advancing Nevada’s Dislocated Individuals (SANDI) project, which uses VR and 3D interactive training to provide career training and short-term credentials through Nevada’s public libraries (Nevada Governor’s Office of Economic

Development, n.d.); however, according SANDI Coordinator, Tammy Westergard, the project has not yet produced research reports or data (T. Westergard, personal communication, March 6, 2023); Ms. Westergard will serve as a member of the external advisory board on this project (see Project Mgmt. section). These examples offer a glimpse of how libraries allow patrons to learn and practice the necessary skills to enter various fields through VR and provide examples of how libraries are partnering with local industries and educational institutions. By offering these programs, libraries are helping patrons to gain new skills and enhance their employability, ultimately contributing to the economic development of their communities.

While the literature on library adoption of VR technology for workforce training and development is limited, recent studies offer a glimpse of the growing body of knowledge. Jumba et al. (2020) found that VR technology can help libraries to reach underserved populations and provide them with access to training and development opportunities and noted that VR can be a cost-effective and efficient way to offer training programs to a large number of people. Matteson and Izenstark (2018) focused on the use of VR in public libraries for STEM education, reporting that VR can be an effective tool for engaging patrons in STEM learning and promoting interest in STEM fields offering hands-on and interactive learning experiences not possible with traditional resources. Morgan et al. (2018) investigated the use of VR in academic libraries for workforce development, revealing that VR can provide an interactive and engaging learning experience, which can be particularly useful for teaching technical skills. Huber and Lankford (2018) found that VR can help libraries provide patrons with access to a variety of career exploration and job training resources.

Existing studies have not explored employment-related outcomes of library-based workforce development programs and services (Mt. Auburn Associates, 2021). This project intends to fill voids in literature by conducting a short-term longitudinal study of VR as an informal, continuous learning approach for exposing job-seeking library patrons to training and career opportunities, thus building upon current practice of VR for workforce development in libraries while enhancing understanding for future practice. ***This project represents the first known research on VR workforce training in public libraries and the first known study to assess***

employment-related outcomes of workforce development services provided by public libraries.

Project Work Plan

Activities. The project will be executed in three sequential phases: 1) Initiation and Planning; 2) Implementation and Evaluation; and 3) Closeout. Table 1 aligns phases with associated activities and the focus of each activity. Activities are associated with five areas of focus: a) progress monitoring; b) research; c) community of practice; d) dissemination; and e) capacity building. A more detailed timeline is found in the “Schedule of Completion” document.

Project Management. PI Mosley will manage the project with assistance of Co-PIs Jin, Sloane, and Ragland. Figure 2 shows the project organizational chart. PI Mosley will serve as overall project lead, managing contracted services (see Resources section) and qualitative research lead. PI Jin will lead quantitative research and supervise the graduate

Table 1. Activities to be carried out.

Phase	Activities	Focus
Initiation and Planning (August 2023 – October 2023)	Monthly project management team meetings	Progress Monitoring
	External Advisory Board meetings	Progress Monitoring
	Instrumentation design	Research
	Secure IRB approval	Research
	Strategy meetings	Community of Practice
	Library staff training for VR programming	Community of Practice
Implementation and Evaluation (October 2023 – December 2025)	Monthly project management team meetings	Progress Monitoring
	Data collection and analysis	Research
	Monthly library professional development meetings	Community of Practice
	Create and update project website	Dissemination
	Quarterly meetings with TRLS leadership	Capacity Building
	Quarterly library visits by research team	Capacity Building
	Podcast recording and production	Dissemination
	Testimony filming and video production	Dissemination
	Invited learning and observation sessions	Capacity Building
	External Advisory Board meetings	Progress Monitoring
	Conference presentations	Dissemination
Annual meetings with aligned workforce boards	Capacity Building	
Closeout (January 2026 – July 2026)	Monthly project management team meetings	Progress Monitoring
	Data analysis	Research
	Monthly library professional development meetings	Community of Practice
	Webinars	Dissemination
	Sustainability plan & best practices guide	Dissemination
	Update project website	Dissemination
	Quarterly library visits by research team	Capacity Building
	Quarterly meetings with TRLS leadership	Capacity Building
	External Advisory Board meetings	Progress Monitoring
	Annual meetings with aligned workforce boards	Capacity Building
	Journal articles	Dissemination
	Conference presentations	Dissemination
Preparing data for public sharing	Research	

assistant. PI Sloane will serve as library partnership lead and oversee accessibility work for products and data sharing. PI Ragland will lead coordination efforts related to meetings and monitoring progress as well as revising digital products for accessibility. All PIs are responsible for dissemination. The project will occur under the advisement of an External Advisory Board (EAB) that will meet twice annually. Members of the EAB and additional information regarding the project team can be found in the “List of Key Staff” document. The team will conduct the project activities and develop a sustainability plan according to the timetable provided in the “Schedule of Completion” document.

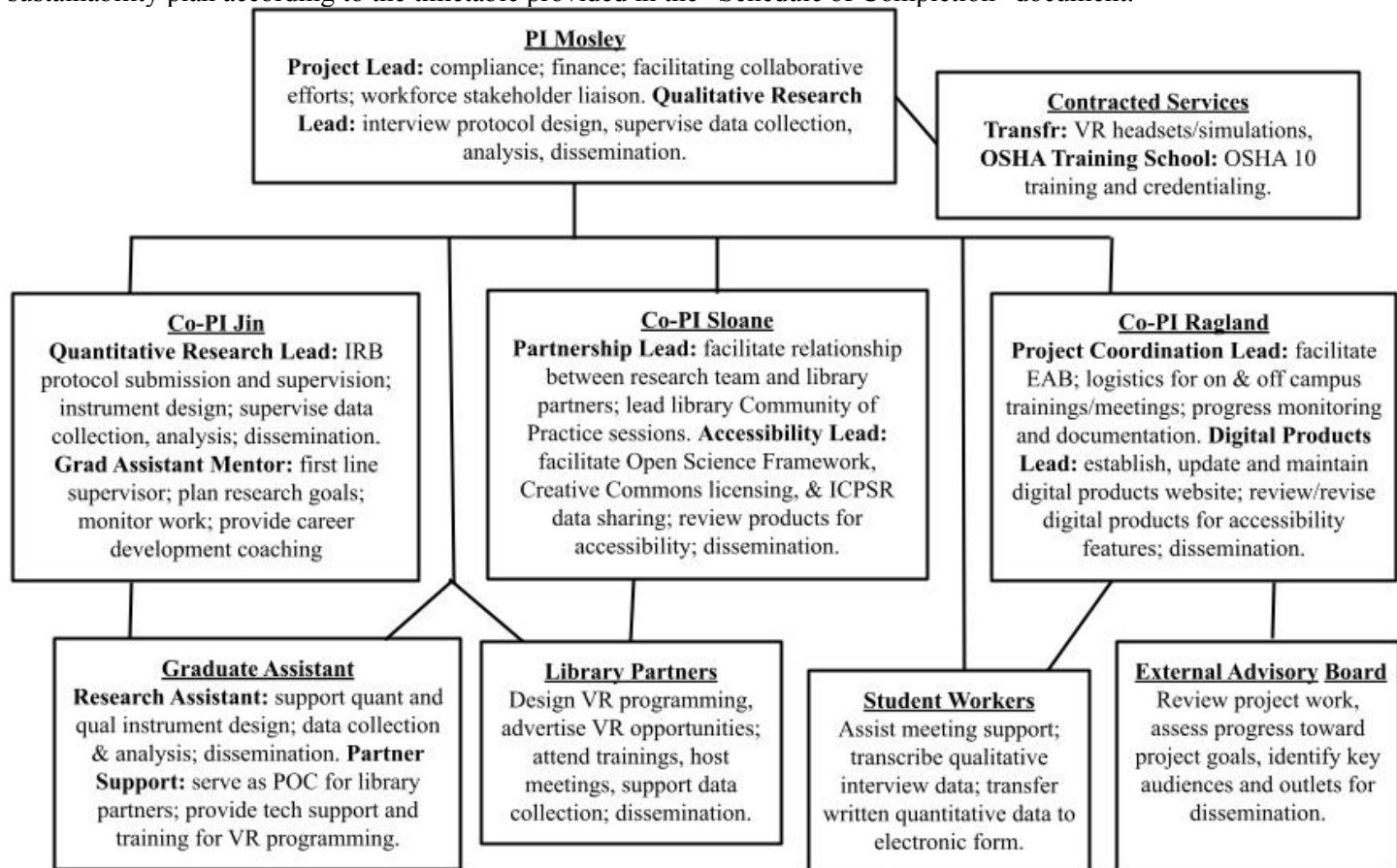


Figure 2. Project management structure.

Resources Needed for Project. MTSU requests \$549,560 as follows: \$203,198 for salary support (four PIs, one grad student support, four EAB stipends, and student workers) and \$31,127 for fringe benefits; \$26,796 for tuition and fees; \$128,895 to be dispersed among participating library partners and participants for VR career training (\$78,300) credentialing (\$10,800), research stipends (\$13,500), travel/lodging/subsistence for partnering library staff to MTSU for meetings/professional development (\$26,295); \$4,000 for supplies; \$1,500 for data storage; \$8,910 for travel (mileage to/from participating libraries for research team; \$28,000 for conference registration/lodging/subsistence for research team and partnering library staff dissemination; \$2,000 for publication costs; \$115,134 for indirect costs at MTSU’s federally negotiated rate. Selected libraries have committed to allocating time for personnel to implement VR programming and will not incur expenses for additional staff. MTSU will contract VR services. Participating libraries will utilize existing library technology (e.g. wifi & computers) and 6.5 feet x 6.5 feet of obstruction-free floor space. Equipment specifications are provided in Supporting Documents supplementary information. Each library will design and implement programming according to the unique geographic and demographic needs. The ways in which programming is offered will also be part of data analyzed under Research Question 2 (see data section below) which will focus on library features.

MTSU will contract with Transfr to provide VR workforce simulations. The project team considered 10 different VR providers offering career exploration and workforce development simulations. Transfr was selected as the VR provider over competitors for three specific reasons: content, customer support, and pricing. The catalog of workforce skills-related content offered by Transfr is superior to competitors regarding quantity, format, and alignment with industry standards. Transfr’s content is delivered via a VR headset and hand controllers to teach motor skills associated with job functions where many competitors primarily focus on augmented reality or 360-degree videos which are less immersive than VR. Given the novelty of the project, customer support was important; other vendors offer only initial onboarding or limit the hours of support provided; Transfr assigns a customer success manager to each client for unlimited support. Transfr’s price structure is on the lower end of the pricing range and is straightforward (see Supporting Documents).

Sustaining and/or replicating the project would allow for using other VR providers that may be more suitable for specific workforce, library, or geographic needs. Therefore, future programming would not rely on Transfr, rather, that would be a place-based decision to be made by libraries and their stakeholders, thus removing concern about possible vendor lock-in. A letter of commitment from Transfr with negotiated costs is provided; also, the project team will contract with OSHA Training School to administer web-based training/credentialing for OSHA 10 (see Supporting Documents).

External Input. This project began with a conversation between the Tennessee STEM Education Center at MTSU and the Tennessee Regional Library System - a state-funded organization that operates as a cooperative of libraries and provides resources and support to libraries across the state of Tennessee. TRLS leadership hosted a virtual meeting for the research team to meet with regional library directors who then sought perspectives from local libraries. A survey was distributed to public library directors across Tennessee where they could express interest in partnering on this grant, provide data to help the research team match libraries for comparison groups (eg. patron visit data, existing workforce development programs, staffing, space, etc.). After selecting library partners, regional workforce boards were contacted to gauge support for the project and surveyed regarding the most pressing workforce needs in their service area. Finally, a meeting with selected library directors was held to ask for perspectives about the approach and answer questions. Iterative design is explained in the data collection section related to research question 1 below.

Progress Monitoring. The progress of the project will be evaluated using the Plan Do Check Act Cycle (Deming, 1982). The principal and co-principal investigators, participating library personnel, and advisory board will meet to plan the initial rollout of activities as described in the grant. A standardized checklist will be developed during the planning phase and used to track the progress of each site. Upon implementation of project activities, feedback will be collected from library personnel and participants and summarized. Feedback will be utilized to identify problems or challenges that need to be addressed as well as to make iterative improvements. Measures will be taken to eliminate problems and reduce the risk of future recurrence. Progress will be tracked monthly by the project team and biannually with the external advisory board against the standard checklist developed in the planning phase. If the progress and outcomes do not meet the expected progress, plans will be developed to address outages or to adjust the timeline and plan accordingly.

Dissemination. The results of this study will be of interest to researchers, practitioners and policy makers. As such, dissemination efforts will be diverse, incorporating a variety of formats for sharing results throughout the grant period. We anticipate a minimum of three peer-reviewed articles in the following journals: (a) Library & Information Science Research; (b) Journal of Research in Technical Careers; and (c) Journal of Vocational Education and Training. We anticipate eight presentations at conferences including: (a) American Library Association annual conference; (b) National Association of Workforce Development Professionals annual conference; (c) International Conference on Transforming Technical and Vocational Education and Training; and (d) Public Library Association Conference, among others. The research-practice partnership team (MTSU researchers and partnering library staff) will collaborate on conference presentations as well as recording podcasts, writing blogs, producing webinars, utilizing social media outlets, employing existing outreach efforts at the Tennessee STEM Education Center (TSEC), and conducting regular meetings. A culminating meeting will be held with the TRLS and the local libraries that fall under the TRLS, including our practice partners in this study, to share project results and identify future direction based on results with the TRLS leaders, local library directors and staff as appropriate, workforce board members, and business and community partners developed with libraries throughout the project. Additional dissemination activities and outlets will be informed by members of the external advisory board. Findings from all research questions will inform the development of a best practices guide.

Theoretical Framing. VR-based training provides learners with an immersive and interactive learning environment, which can support their learning by enabling them to actively engage with the content (Yang et al., 2021). These environments are designed to simulate real-world experiences, providing an opportunity to practice skills and knowledge in a safe and supportive environment. Experiential Learning Theory suggests that learning is achieved through the process of reflection and experimentation (Kolb, 1984). VR-based training can support this process by providing learners with opportunities for reflection and feedback. By using VR-based simulations, learners can receive immediate feedback on their performance, which can help them to reflect on their actions and improve their skills (Yang et al., 2021). Experiential Learning Theory suggests that reflection and feedback are essential components of the learning process (Kolb, 1984). In addition, VR-based training can provide learners with opportunities to experiment with different roles and identities. VR environments can simulate different job settings and allow learners to experience what it is like to work in a particular field. Experiential Learning Theory suggests that learners develop knowledge and skills through experimentation and exploration (Kolb, 1984). By providing learners with a safe and supportive environment to explore different careers and identities, VR-based training can help them to make more informed decisions about their career paths.

By providing learners with engaging and authentic contexts for learning, collaborative learning opportunities, and feedback on their performance, VR-based training can support the development of learners' knowledge, skills, and sense of career identity. Furthermore, VR-based training can help learners to experiment with different roles and identities,

leading to more informed decisions about their career paths. As VR technology continues to evolve, it has the potential to become an even more powerful tool for supporting career exploration and development.

The experiential learning cycle shown in Figure 3 illustrates the learning process associated with Experiential Learning Theory in four steps. The first step is the Concrete Experience, where the learner is introduced to a new experience or interprets an existing one in a new way. *In this project, the concrete experience would be the Career Exploration VR module.*

The second step is Reflective Observation, where the learner reflects on the experience, considering inconsistencies between their experience and their existing knowledge. *In this project, the second step would be facilitated by a user experience survey.*

In the third step, Abstract Conceptualization, the learner creates or modifies their existing ideas based on their reflection. *In this project, patrons would make meaning from the VR experience and survey.* Finally, in Active Experimentation, the learner applies their new or modified ideas in real-world situations to see what happens. This cycle of learning can be repeated as necessary to continue building knowledge and skills. In this project, if the VR experience leads patrons to new career interests, there will be options for sequential learning, enabling further career development.

Research Questions, Methods, and Data. The hypotheses regarding associations between VR training and workforce outcomes and library features will be tested by research questions 1 and 2, which are directly derived from objectives 1 and 2.

Objective 1: Explore the association between VR training and workforce outcomes, especially in economically distressed areas.

Research question 1: What are the associations between VR training and workforce outcomes?

The project team will employ a quasi-experimental design to explore the association between VR training and workforce outcomes. Using the two libraries in the economically distressed area as an example, the project team will assign either the VR-Career module or the VR-Career-Plus module to each of these two libraries. The **VR-Career module** is composed of exposure simulations for 7 careers, including manufacturing, skilled trades, warehousing and storage, public safety, hospitality and tourism, automotive, and health care. These career exploration hands-on simulations showcase different career paths that allow job seekers to understand their career options and experience what it's like to work in different careers. The VR-Career module is to provide patrons with VR experience prior to VR training associated with the careers explored in the VR-Career modules. **The VR-Career-Plus** module contains exposure simulations for 7 careers **PLUS** more than 250 robust, in-depth virtual training simulations grouped by careers. For illustration purposes, table 2 provides a list of simulations for the VR-Career and VR-Career-Plus modules for a career in warehousing and storage. The library receiving the VR-Career module is considered the control group, and the library receiving the VR-Career-Plus is considered the experimental group. Significant variation in patron workforce outcomes between the control and experimental group shows evidence of associations between VR training and workforce outcomes in this area after controlling for the effects of patron characteristics (e.g., education) and the number of completed training. The association between VR training and workforce outcomes will be examined in the same way for libraries in economically at-risk and transitional areas.

Data collection. A patron survey will be administered before and after VR training to collect patron data on their characteristics (i.e., gender, age, ethnicity, education, prior work experience, income, marital status, disability, veteran status, and prior VR experience), user experience with VR training (either VR-Career or VR-Career-Plus), voluntary contact information for future data collection. In 6 months after patrons receive VR training, the project team will survey them via emails, phone calls, or text messages regarding their workforce outcomes, including new careers explored, new employment-related skills obtained, credentials in progress or earned, and new employment as a result of VR training. In addition, interviews will be conducted with voluntary patrons to gain insights regarding their experience with VR training, such as how VR training leads them to their current employment and why they do not seek employment with VR training. By the end of the first 12 months of the implementation, the project team will perform a mid-term evaluation based on the patron survey data and the follow-up survey data to assess the quality of and associations between the VR training on workforce outcomes and propose modifications to the VR training modules or implementation to improve the program.

Data analysis. Patron survey data will be used to conduct regression analyses to explore the association between VR training (independent variable) and each workforce outcome (dependent variable) while controlling for patron

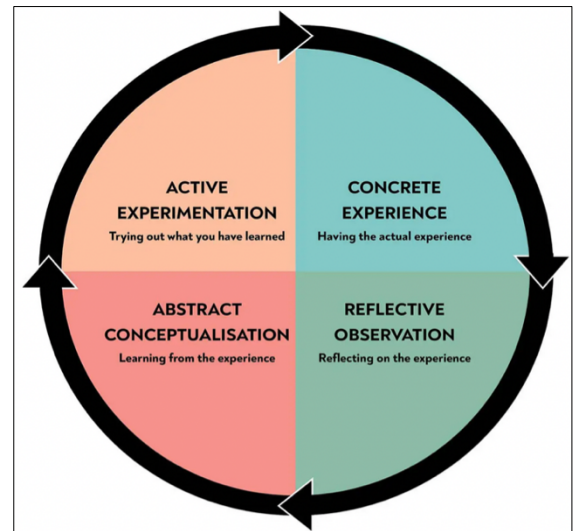


Figure 3. Experiential learning cycle (Simply Psychology, 2021).

characteristics (covariates) in each economically distressed/at-risk/transitional area. Positive and significant ($\alpha=0.05$) regression coefficients of VR training in these regression analyses will indicate positive associations between VR training and workforce outcomes. Interview data will be used to perform content and semantic analysis to gain insights into how VR training is associated (or not associated) with workforce outcomes from the patron's perspectives.

Objective 2: Identify library features

that facilitate or hinder patrons from receiving VR training across multiple library locations.

Research question 2: What are the library features (e.g., the seclusion of the training space) that tend to encourage/discourage patrons from receiving VR training?

Because libraries directly interact with their patrons and VR training is implemented by library staff, it is important to understand what library features could hinder or facilitate patrons from receiving VR training.

Data collection. After having the onsite VR training for 12 months in the libraries, three library feature surveys will be distributed to patrons with different VR experiences via onsite surveys (to all library visitors), emails, and text messages regarding library support for VR training, such as the awareness of the training, the accessibility of the training, the library staff support of the training, the follow-up information provided regarding related skills training and employment opportunities, and other library features identified by patrons. The first survey will be administered to patrons who choose not to experience VR-Career or VR-Career-Plus during their visits to the library. Analysis of this survey data will provide valuable information to inform the project team regarding the library features (e.g., the seclusion of the training space) that discourage patrons from receiving the VR experience (VR-Career) or training (VR-Career-Plus). With this information, the project team will work with the library staff to make proper modifications to the program for future implementation. The second survey will be administered to patrons who choose to take the VR-Career Module but do not move forward with the VR-Career-Plus module. Analysis of this survey data will inform the project team regarding library features that facilitate patrons to experience VR (i.e., VR-Career) but hinder them from taking the VR training (i.e., VR-Career-Plus). The third survey will be administered to patrons who choose to take the VR training (i.e., VR-Career-Plus). Analysis of this survey data will inform the project team regarding library features that promote patrons to receive VR training. The first library feature survey will be administered at all libraries and the second and third library feature surveys will be administered at libraries assigned with the VR-Career-Plus module. In addition to surveys, interviews will be conducted with selected patrons with different VR experiences regarding their perspectives on library features to supplement to survey data.

Data analysis. Descriptive statistics (mean and standard deviations) will be calculated for each library feature measure (e.g., accessibility of the training) on the library feature survey for an overview of each library. Additionally, differences in library features between patrons with different VR experiences will be calculated to investigate the effects of library features on workforce outcomes after controlling for patron characteristics. The statistical method used for this analysis is an analysis of variance with covariates (ANCOVA), with workforce outcomes as dependent variables, different VR experiences as independent variables, and library feature and patron characteristics as covariates. Interview data will be analyzed via content and semantic analysis to gain insights into the effect of library features on workforce outcomes. The project team will incentivize patrons to participate in the research by providing a stipend each time they complete a survey or participate in an interview.

Objective 3: Develop a sustainable model for continuation and replication of this project.

Research question 3: What are the obstacles and opportunities for participating libraries with regard to achieving long-term sustainability for offering virtual reality workforce development programming?

The project team will actively seek external support to achieve long-term sustainability by the project's conclusion, including soliciting support from all potential stakeholders.

Data Collection. Data will be collected in two phases: (1) focus groups with library staff, workforce boards, and employers; and (2) semi-structured interviews and open-ended questionnaires with library staff, workforce boards, and employers. Focus groups and semi-structured interviews will be recorded and transcribed in preparation for analysis.

Table 2. VR-Career module and VR-Career-Plus module for a career in warehousing and storage: An illustration

Career exploration simulations	In-depth, career-specific skills training
Warehouse Inventory Receiving Specialist	<ul style="list-style-type: none"> - Inspecting and identifying hand tools correctly - Materials handling: situational awareness; storage safety; metal/glass sheets and cylindrical objects (<i>aligns with OSHA 10</i>) - Fire extinguisher safety (<i>aligns with OSHA 10</i>) - Safety data sheets for chemical hazards (<i>aligns with OSHA 10</i>)
Warehouse Worker	<ul style="list-style-type: none"> - Ladder safety: straight ladders (<i>aligns with OSHA 10</i>) - Ladder safety: a-frame stepladders (<i>aligns with OSHA 10</i>) - Fire extinguisher safety (<i>aligns with OSHA 10</i>) - Safety data sheets for chemical hazards (<i>aligns with OSHA 10</i>) - Personal protective equipment use (<i>aligns with OSHA 10</i>)
Hoist/Crane Operator	<ul style="list-style-type: none"> - Materials handling: Hoists & Cranes (<i>aligns with OSHA 10</i>) - Energy related hazards: electrical safety; GFCI; electric shock (<i>aligns with OSHA 10</i>) - Personal protective equipment use (<i>aligns with OSHA 10</i>) - Lockout & Tagout procedures (<i>aligns with OSHA 10</i>)

Note: VR-Career module contains only career exposure simulations (column 1) and the VR-Career-Plus module contains both career exposure simulations and VR training associated with careers (columns 1 & 2).

Data analysis. Data will be analyzed in two phases, aligned with data collection, to understand challenges and opportunities libraries face to achieve long-term sustainability using first and second cycle coding strategies (Saldana, 2015). In the first phase of data analysis, focus group data analysis will employ four compatible approaches to coding: (a) values coding; (b) evaluation coding; (c) dramaturgical coding; and (d) attribute coding. In the second cycle, codes from the first cycle will be combined based on similarities. In the second phase of data analysis, additional codes from interviews and open-ended questionnaire responses will be developed inductively if participants mention factors other than those discussed in focus groups. Qualitative findings (RQ3) and quantitative results (RQ1 and RQ2) will be triangulated (Creswell, 2015). In order to reduce bias, data source triangulation will be used in this project (Merriam, 2002). Multiple qualitative data sources (i.e. focus groups, interviews, and open-ended questionnaire responses) will be used to establish rigor and credibility of the findings; researchers will determine how findings are supported by these data sources. Additionally, all coding will be completed by two researchers (PI Mosley and Postdoc Researcher). The researchers will code the qualitative data separately and meet to discuss the codes until a consensus is reached in order to increase the trustworthiness of the analysis.

Relevance. VR technology has become increasingly popular in recent years, with its applications in various fields such as entertainment, healthcare, education, and career development. Libraries have a unique opportunity to incorporate VR technology into their programming, specifically in the areas of career exploration and workforce development and training. Currently, few libraries incorporate VR career exploration and workforce training into their programming; however, this technology can enhance current practice and offers numerous benefits to both libraries and patrons. By providing opportunities for skills development through VR, libraries can help patrons build the skills necessary to succeed in the workforce (Huang, et al., 2018). VR training that is up-to-date and relevant to current job market trends can help library patrons develop the skills and knowledge necessary to succeed in the workforce, and can increase their employability (Li, et al., 2021). Incorporating VR training into library programming can increase access to workforce development resources to a wider audience, regardless of their financial resources (Huang, et al., 2018). By incorporating VR technology into library programming, libraries can show they are at the forefront of technological advancements and dedicated to providing the best possible service to their patrons (Li, et al., 2021), which may increase their relevance in the digital age and encourage more people to visit and use their services (McLain, 2021).

Institutional Review Board. This study will require Institutional Review Board (IRB) approval. Submission to IRB requires all research instruments to be complete; therefore, the research team has not yet submitted for IRB approval as the research instruments will be developed with input from project partners (i.e. libraries). However, the research team is familiar with and successfully received IRB approval for numerous research projects involving human subjects. MTSU allows for an expedited IRB review procedure for research involving human subjects that are completed within two weeks. To qualify for expedited review, studies must present no more than minimal risk to human subjects and can involve (a) collection of data from documents; (b) collection of data from voice, video, digital, or image recordings made for research purposes; and (c) research on individual or group characteristics or behavior. Therefore, we expect this study will qualify for expedited review, thus allowing the research team to proceed with the proposed timeline.

Diversity Plan

Diverse Perspectives and Participant Involvement. As this project aims to serve individuals of diverse geographic and socioeconomic backgrounds, equity and accessibility of VR technology is important. Transfr's VR platform has a model that improves equity and accessibility by increasing access to educational opportunities that are often unavailable to rural or under-resourced organizations due to lack of transportation, lower per-person resources, and a smaller employer base. Our project addresses such barriers by providing VR Headsets that are portable with a built-in digital instructor who coaches individually and provides standardized training to all students, turning any facility with wifi into an industry training facility. Also, with the comfort of VR, participants can safely evaluate their skills alignment without fear of ridicule (e.g., a female who could undergo a variety of simulations, perform best in construction, and then pursue information on pathways without external influence). The iterative research design will employ patron surveys, with responses being used to propose modifications to library VR implementation, ensuring diverse perspectives of participants are involved in defining challenges and opportunities of library-based VR for workforce development and crafting how VR is implemented at each library.

Strengthening Commitment. To strengthen the library science field's commitment to diversity, equity, and inclusive practices, the project team will employ the Equity Framework for Career and Technical Education Research (National Research Center for Career and Technical Education [NRCCTE], 2022). The research team will utilize the framework's checklist consisting of six key principles that reflect a holistic and intersectional approach to equity research guide: 1) recognize the historical and structural context; 2) center the voices of marginalized and oppressed populations; 3) engage in equitable partnerships and collaborations; 4) attend to issues of power and privilege; 5) employ culturally responsive and inclusive methodologies; and 6) promote equity-driven dissemination and advocacy (NRCCTE, 2022).

Project Results

Intended Results. While this project does not predetermine outcomes of the study, we intend results will reveal any associations between VR training and workforce outcomes, identify factors that facilitate or hinder patrons from receiving VR training and pursuing credentialing or employment opportunities, and inform a sustainable model for continuation and replication of this project. Should positive associations between VR training and workforce outcomes be identified, results will contribute to empirical evidence for wide-spread adoption of VR workforce training in libraries. Should results not reveal positive associations between VR training and workforce outcomes, the sustainability model would be applicable for other library-industry partnership projects focused on workforce development.

Access to Deliverables. The outcomes of this project will include multiple deliverables, which will be broadly accessible through repositories, publications, and websites, and through program participation by beneficiaries. Preliminary results, documentation, and collaboration tools will be shared throughout the grant period with partners and via online collaboration spaces such as a project website and Open Science Framework project profile. When possible, we will assign Attribution 4.0 International Creative Commons license to promote replicability and allow others to share and adapt the content created. Research data will be findable, accessible, interoperable, and reusable. PIs will develop protocols for monitoring, quality control and version control. Data will be shared through curated submission to Inter-university Consortium for Political and Social Research (ICPSR) and will utilize the Dublin Core metadata schema. Storage, preservation, and long-term access will be addressed specifically to each deliverable.

Description of Deliverables: (a) a best practices guide for other libraries by documenting processes and outcomes - specific deliverables will include progress reports, patron surveys, programming descriptions, and promotional materials; (b) the project will develop or enhance collaborations between libraries and stakeholders; (c) research products including quantitative and qualitative research instruments, journal articles, and conference presentations; (d) media materials for communication purposes (podcast production and recordings and testimony films via video production); and (e) a README.txt file to document, collaborate, monitor, and share details about the project and project deliverables.

Sustainability. The third objective for this project is to develop a sustainable model for VR programming in libraries that supports workforce development initiatives. The project team will actively seek external support to achieve long-term sustainability by the project's conclusion, including soliciting support from all potential stakeholders. Three project activities aimed at capacity building by stakeholders will support this line of inquiry: 1) quarterly meetings with TRLS leadership; 2) invitational learning & observation sessions for employers held at participating libraries; and 3) annual meetings with aligned regional workforce boards. These meetings will provide a platform for focus group discussions around the sustainability of this project. These stakeholder groups will be able to evaluate the utility of VR training for meeting workforce demands. **The primary concern with sustaining and expanding the effort is the cost associated with providing VR simulations as well as costs for industry credential exam fees.** The project is designed such that libraries are able to utilize existing staff and technological capabilities (i.e. standard WiFi bandwidth). The American Library Association (2023) encourages agencies involved with economic opportunity development to include libraries in planning, supports career exploration and workforce development programming through libraries, and promotes cooperation across funding streams in the programmatic delivery to job seekers. To that end, we intend to: (a) engage employers in discussions about training needs that are being met by the VR simulations and how they align with job opportunities; and (b) engage workforce boards in discussions about cooperating with libraries offering VR training for workforce development to support the costs associated with the technology and credentialing fees by utilizing funds from the Workforce Innovation and Opportunity Act (WIOA). The research team views the possible collaboration between libraries and workforce boards to implement WIOA funded programs as a high value opportunity for sustainability. WIOA can fund training and credentialing program fees associated with workforce development through its Adult and Dislocated Worker Programs. While novel in Tennessee, some libraries across the country have utilized WIOA for workforce programming such as the Public Library of Cincinnati and Hamilton County in Ohio, the Brooklyn Public Library in New York, and the Charlotte Mecklenburg Library in North Carolina. Therefore, possibilities for sustaining this project will be explored from multiple angles.

National Impact. This project has the potential for national impact in several ways. First, it is focused on providing access to workforce development resources to a diverse population, including those who may have been historically marginalized and excluded from opportunities. By leveraging the infrastructure and reach of public libraries, we will be able to reach a broad cross-section of the population and help bridge the digital divide that often limits access to training and credentialing programs. Second, the project has the potential to serve as a model for other libraries across the country. By documenting processes and outcomes, we can share successes and challenges with other libraries and help promote best practices in workforce development. Third, as the project aligns with national workforce development initiatives and priorities, including those outlined WIOA, USDOL Training and Employment notices, and IMLS priority areas, results will provide empirical data regarding collaborations between public libraries and the workforce investment system.

Type: What types of digital products will you create?

The outcomes of this project will include multiple deliverables, which will be broadly accessible through repositories, publications, websites, and social media. We anticipate our many project partners will disseminate digital products as an outcome of participation. Therefore, this project will have a wide impact on the library, workforce, education, business development, and immersive technology communities of practice. The digital product type and availability are summarized in Table 1. Types, quantity, and availability of digital products are shown in Table 1.

Table 1. Type and Availability of Digital Products

Types of digital products we will create	Quantity	Availability of our digital products
Best practices guide for public libraries documenting processes, outcomes, and impact	1	OSF; TSEC website
Quantitative research instruments (i.e. patron surveys)	3	OSF; ICPSR
Qualitative research instruments (i.e. interview protocols)	3	OSF; ICPSR
Research products to address scholarship gaps (i.e. peer-reviewed journal articles)	3	Publications; OSF; Linked from TSEC website
Deidentified quantitative data sets (.csv)	2	OSF, ICPSR
Deidentified qualitative data sets (from focus groups and interviews), including coding scheme for analysis (.pdf)	3	OSF, TSEC website
Marketing materials from library partners	>6	OSF; TSEC website; social media; TRLS communications channels
VR in Public Libraries for Workforce Development Podcast	18 episodes	Anchor podcasting platform; TSEC website; OSF
Library staff and patron testimony videos	18	YouTube; TSEC website; OSF
Conference presentations	8	Conference recording portals
Readme.txt file	1	OSF

Availability: How will you make your digital products openly available (as appropriate)?

As an outcome of the activities and collaborations described in the proposal, we will be able to meet the diverse audiences for our digital products by making them accessible through multiple means. The digital projects will include a program website managed by the Tennessee STEM Education Center (TSEC). We will utilize social media through organizational accounts and library partner social media profiles. An OSF project page will provide access to the research design, research instruments, and related documentation. The TSEC website will link to the OSF project page. We will share our results via a curated submission to Inter-university Consortium for Political and Social Research (ICPSR), and a page for the study itself will be created to provide open access to all published data.

Preliminary results, documentation, and collaboration tools will be shared throughout the grant period with partners and via online collaboration spaces such as a project website and Open Science Framework project profile. As we begin to expand our project via professional development for library personnel, digital products to support the training and collaboration will be shared via the project website, and project partners' online dissemination.

Access: What rights will you assert over your digital products, and what limitations, if any, will you place on their use? Will your products implicate privacy concerns or cultural sensitivities, and if so, how will you address them?

When possible, we will assign Attribution 4.0 International Creative Commons license to promote replicability and allow others to share and adapt the content created. The Data Management Plan document addresses how we will ensure the protection and privacy of human subjects through our IRB protocol. In all our activities, communications, and documentation, we will seek to be aware and understanding of privacy concerns and cultural sensitivities. Federal Agencies Digital Guidelines will be utilized for digital product creation methodologies.

Sustainability: How will you ensure the sustainability of your digital products?

The principal investigators will develop protocols for monitoring, quality control and version control, as each product is in development throughout the period of performance. Storage, preservation, and long-term access will be addressed specifically to each deliverable. We anticipate that products may have a specific period of use, depending on whether they were created for use during the period of performance, or final version for publication and storage. The platforms and portal that we are using to facilitate availability of the digital products will also serve as a means of preservation.

Statement of Mission

Middle Tennessee State University embraces its role as a comprehensive, innovative institution whose distinctive bachelor's, master's, specialist, and doctoral programs prepare graduates to thrive in their chosen professions and a changing global society. Students, faculty, and staff generate, preserve, and disseminate knowledge and collaboratively promote excellence through teaching and learning, research, creative activity, and public engagement. This statement of mission was approved April 5, 2022, by the MTSU Board of Trustees; the official documentation of approval is available in the April 2022 Spring Quarter Board Meeting documents - <https://www.mtsu.edu/boardoftrustees/meetings/234/2022-04-05>.

Service Area

Middle Tennessee State University, a coeducational, tax-supported institution founded in 1911, is located in Murfreesboro less than a mile from the exact geographic center of the state. Murfreesboro, a historic city of over 100,000, is 32 miles southeast of Nashville via I-24 and is easily accessible from any direction. Designated a regional university, MTSU provides services and continuing education to the central Tennessee area. Some 80 percent of the school's more than 900 full-time faculty members hold terminal degrees. The student body numbers more than 26,000 and comes from 94 Tennessee counties, 45 states, and 74 foreign countries.

Governance Structure

Middle Tennessee State University's Board of Trustees is being established under the auspices of the Focus on College and University Success (FOCUS) legislation that was introduced by Gov. Bill Haslam in 2015 and, in 2016, passed by the General Assembly and signed into law. The FOCUS Act calls for the Board of Trustees to be the University's governing body. The Board will be responsible for selecting and appointing the president; setting the operating budget; approving personnel appointments; granting all degrees awarded by the University, including honorary degrees; establishing tuition and fee rates; approving contracts; and approving all rules, regulations, curriculum changes, new programs and degrees of the University.

Brief History of MTSU and the Tennessee STEM Education Center

Opening on September 11, 1911, with a two-year program for training teachers, Middle Tennessee State Normal School evolved into a four-year teachers college (Middle Tennessee State Teachers College) in 1925, and the degree program changed to four years leading to a bachelor of science degree. In 1943, the General Assembly designated the institution a state college. In 1965, the institution was advanced to university status. Since 1911, MTSU has graduated more than 100,000 students. The Tennessee Science, Technology, Engineering and Mathematics (STEM) Education Center (TSEC) at MTSU is the organizational unit that will carry out this project. TSEC is a research and outreach arm of MTSU, aimed at improving K-20 STEM education both locally and nationally. TSEC, established in 2003, partners with internal and external stakeholders to identify and address critical issues that impact access, equity, innovation, and leadership through collaborative activities, sponsored projects, and dissemination products at professional meetings and in practitioner and research journals.

Data Management Plan

I. Repository and Types of Data

The project PI will oversee implementation and monitoring of the data management plan (DMP). The plan will be utilized through the data collection, analysis, curation, and sharing processes. Monthly project management team meetings will be utilized to review the DMP with regard to data discussed. The DMP will be shared with the external advisory board as well for additional monitoring during twice-a-year meetings.

Preliminary results, documentation, and collaboration tools will be shared throughout the grant period with project partners and the external advisory board via regularly scheduled meetings. Information will also be shared to a public facing audience through online collaboration spaces: (a) a project website (through the Tennessee STEM Education Center at MTSU); and (b) an Open Science Framework project profile. Research data will be findable, accessible, interoperable, and reusable. PIs will develop protocols for monitoring, quality control and version control. Data will be shared through curated submission to Inter-university Consortium for Political and Social Research (ICPSR) and will utilize the Dublin Core metadata schema.

A variety of different types of data will be collected during this project. Because this project involves research with human subjects, this data will be collected in accordance with the data collection and data management policies of the Institutional Review Boards at Middle Tennessee State University, including consent agreements of participants. We will generate participant responses to surveys and other instruments as well as audio and/or video of participant interviews.

Surveys will be associated with a unique participant ID such that survey responses will be de-identified and can be linked over time. As practical, surveys will be administered in electronic form using Qualtrics to facilitate the import into statistical software. Records will be de-identified and stored in a .csv file. Analytical procedures for each type of data will be captured.

Interviews will be conducted either by video conference using the Zoom software, telephone, in-person, or text messaging based on the needs and accessibility of participants. Audio and/or video will be recorded for the interviews using Zoom. All interviews will be transcribed. All videos, audio files, and transcripts will be stored in a secure cloud storage system. Analysis of qualitative data will result in a codebook.

II. Data and Metadata Standards

Video data will be stored in the original format and an HTML5-compatible format, such as H.264+AAC as MP4. Audio data will be stored in its original format, WAV. All other files will be stored in their original format. When multiple sources of video and audio are captured simultaneously, synced versions of these files will be created and stored. For observational data, metadata about the date collected, name of data collector(s), the recording equipment used, the position of recording equipment, the recording settings, the location recorded, and participants included will be saved as metadata. For surveys, including open-ended questionnaires, the date

collected, name of the survey administrator(s), format for administration (e.g., online vs. paper), and the instrument used will be saved as metadata. These details will be stored in an excel spreadsheet or database.

III. Policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements

The project PI will be responsible for safely storing, and accurately recording and storing the consent forms and data collected for the project. The data will be input on password protected laptops or desktops that are in the project workspace, and securely locked before and after use. All data in electronic form will be saved to secure cloud storage at least weekly, which will be synced to a secured physical location. Hard copies of consent forms and data will be locked in a storage cabinet. Only the members of the research team (e.g., lead researcher, project researchers, student research assistants) will have access to the data. All of these members will be included on the IRB form, and will have completed the IRB training.

To further protect participants, all quantitative data will be de-identified prior to analysis. All data at the individual student level will be associated with an individual by a unique ID. Participants will be asked to provide a desired pseudonym (or one will be selected if they have no preference) to refer to individuals in an anonymized way in publications. One password-protected file will be kept that links participants names with unique ID and pseudonym, which will be stored in the same location as the consent forms.

The project PI will be responsible for ensuring compliance with the data management plan throughout the timeline of the award. Should the PI leave the project or institution, a senior researcher at the home institution will be named as the responsible party.

IV. Policies and provisions for reuse, redistribution, and the production of derivatives and plans for archiving data, samples, and other research products, and preservation of access

Primary data gathered and other supporting materials created in the process of the proposed research will be de-identified and shared with other researchers, institutions, and/or stakeholders through the data repository, following its regulations for registration and access. Additionally, any data collection or analysis instruments developed or revised in the project will be made available through the same portal, no later than the date of publication and for a period no less than 10 years from the project end date.