Who is the lead applicant and, if applicable, who are the collaborators?
Fort Hays State University's (FHSU) Forsyth Library is collaborating with the FHSU Institute for New Media Studies (INMS) on this project. Claire Nickerson, Learning Initiatives & OER Librarian, will serve as the Principal Investigator and Gordon Carlson, Director of the INMS, will serve as the Co-PI. We will work with two consultants, Laurel Zhang of the Wichita Exploration Place and Kristin Fontichiaro of the Michigan School of Information, and with an advisory board of librarians from the University of Nebraska at Kearney, University of Kansas, Kansas State University, Pittsburg State University, Dodge City Community College, Johnson County Community College, and Labette Community College.

What do you plan to accomplish and why?
We will build a low-cost, portable, modular smart classroom kit. The kit will make it possible for smaller institutions, particularly in rural areas, to provide smart classroom technology without a large investment of time, funding, or building renovation, thereby promoting digital inclusion for rural students.

What is the time frame for the project?
The project will run from October 1, 2018 through September 30, 2019.

What library and community needs will the project address?
Rural students frequently come from communities and attend institutions where they do not have the opportunity for connected learning. However, connected learning spaces are useful for teaching data literacy and visualization as well as spatial reasoning, math, and logic. They provide opportunities for utilizing gamified instruction and familiarizing students with new technologies that they may encounter in the workforce. For academic libraries, smart classroom technology can enable new types of events and exhibits, such as interactive 3D models of archival artifacts and documents too fragile for physical interaction, research data visualizations, or architectural models. We will focus on academic libraries given the short time frame, but we envision that in the long run, the kit could be impactful for public libraries and museums as well.

Who is the intended audience for the activities?
The primary audience is underserved college students at small and rural academic libraries. The secondary audience is small or rural academic institutions that are eager to move into the connected learning space but do not have the means to do so in a traditional manner due to limited funding.

What will be the specific project activities, performance goals, outcomes, results, and tangible products?
In the planning phase, October - December, we will consult with and hold virtual focus groups with our collaborators to discuss desired design features and functionality for the smart classroom kit. During the development phase, January - May, we will create a prototype of the kit based on input from our advisory group and consultants. We will then offer sample programs and exhibits, both at FHSU and at other institutions, to test its functionality and portability. In the documentation phase, June - September, we will write a list of required and recommended components, assembly instructions, suggestions for programming and assessment, and a pedagogical and technical training manual. We will also disseminate our results during this phase.

The setup cost of the smart classroom kit will be less than $500 for institutions that already own the equipment, $14,000 for a simplified version, or $25,000 for a full complement of equipment. The time required to set up the kit will be less than two hours, with teardown time less than one hour.

What are the intended outcomes for audience members in terms of measurable changes in knowledge, attitudes, or behavior?
70% of students attending sample programming will indicate that the smart classroom kit increased the quality of their learning experience, offered learning opportunities that traditional classrooms cannot provide, and increased their understanding of the information taught.

Fort Hays State University

Statement of National Need

What current, nationally significant challenge does your proposal address? Specifically, how will your project address the issues identified in the project category you selected?

Our project addresses several current, nationally significant challenges: providing underprivileged students with access to new technologies, teaching data literacy and spatial reasoning, and demonstrating that libraries, far from being obsolete, are often early adopters of emerging media. It meets the goals of the IMLS National Leadership Grants for Libraries Program by serving as a Community Anchor. The focus groups we'll use to develop our smart classroom design and functionality will foster community dialogue related to connected learning among different types of academic libraries. The low-cost smart classroom kit itself will enhance equity and access to new technologies. In addition, it will promote digital inclusion at institutions where the cost of installing a traditional smart classroom would be prohibitive, but where students still need to gain data literacy skills and be prepared for rapid technological change.

Our smart classroom kit also has the potential to transform programming by enabling libraries to offer more digitally interactive events and exhibits. These activities will encourage cultural engagement and draw students to interact with libraries in new ways. Using smart classrooms for events and exhibits provides an opportunity to dispel the widespread myth that libraries are obsolete (Herring, 2014), whereas in reality, libraries are frequently early adopters of new technologies.

Who will benefit from the project? How have you identified or assessed the challenges or needs of this audience or participants?

The primary beneficiaries of our project are rural and underserved students. Providing students with access to new technologies is critical to preparing them for rapid technological change in the workplace (Warschauer & Matuchniak, 2010). Students in rural areas, including western Kansas where Fort Hays State University (FHSU) is located, often lack access to new technologies provided by larger institutions with more resources. This limits opportunities for them to experiment and learn skills such as data visualization, spatial reasoning, and connected learning.

Smart classrooms provide a space to teach students about data visualization and literacy, which is a national need in the era of big data. They help to improve students' understanding of statistics, graphs, data-driven arguments, personal data management, research, and ethical data use (Carlson, Nelson, Johnston, & Koshoffer, 2015; Fontichiaro & Oehrli, 2016; Prado & Marzal, 2013). They also provide a space for students to experiment with new technologies, such as augmented and virtual reality, and to collaborate on 3D digital projects.

The Center for the Future of Libraries (2016) confirms that the smart classroom kit is a timely project by identifying four relevant trends: "Connected Learning," emphasizing that students need access to new technologies to level the playing field and facilitate hands-on, collaborative learning; "Data Everywhere," as data collection is on the rise and students must know how to work with it, especially with data management being a valuable job skill; "Digital Natives," emphasizing that the current generation of students sees the world in a new way requiring instructors to investigate new teaching styles; and "Gamification," which promotes spatial reasoning, math, and logic.

Our smart classroom kit project will also benefit smaller libraries by enabling them to offer new types of digital events and exhibits. For instance, smart classrooms can provide access to interactive 3D models of archival artifacts and documents too fragile for physical interaction. This capability draws students into libraries and provides the opportunity for them to explore cultural heritage. Smart classrooms can also be used to showcase other types of exhibits, such as interactive research data visualizations or architectural models.

How does this proposed project differ from, complement, or build upon theory, scholarship, and practice in this area?

Smart learning spaces are not new. The first well-known and most ambitious example is the Cave Automatic Virtual Environment, developed at the University of Illinois at Chicago in 1992 (Cruz-Neira, Sandin, DeFanti, Kenyon, & Hart, 1992). It was later reprised and improved as CAVE2 in 2013 to offer enhanced screens, processing capability, and optical tracking. However, most early smart learning spaces were in museums, including virtual museums (Antonaci, Ott, & Pozzi, 2013; Ismaeel & Al-Abdullatif, 2016) and interactive spaces within traditional museums (Gül & Akmehmet, 2015). For example, the J. Paul Getty Museum hosted a 2005 symposium on family-oriented interactive spaces in museums, which inspired a number of installations at museums across the country (Schubert, 2000).

"Smart classrooms" are a newer concept, only gaining popularity within the last ten years. Although there is no universal definition as to what features constitute a smart classroom, they do couple technology closely with learning spaces, either to augment the space or as integrated infrastructure within the space. Examples of technology used to augment learning spaces include interactive whiteboards (Manny-Ikan, Tikochinski, Zorman, & Dagan, 2011) and smart clickers (Graham, 2013), which make the learning experience more engaging, interactive, and multidimensional. Integrated infrastructure approaches include tablet-based classrooms (Kim, Park, Yoo, & Kim, 2016), the interactive cloud-classroom (Liou, Bhagat, & Chang, 2016), or more computationally intensive experiences such as realistic conversations with an avatar in *Project LifeLife* (Gonzalez et al., 2013) and the global collaboration Visualcasting system (Renambot, Jeong, Hur, Johnson, & Leigh, 2009).

Academic libraries have been heavily involved in the creation and use of smart classrooms. Early library smart classrooms provided augmented rather than integrated infrastructure (Wang, 2008, p. 156), and although there are now more technology options than just interactive whiteboards, budgetary and space limitations continue to prevent many academic libraries from taking advantage of them (Baglier & Caswell, 2016).

All of these previous smart spaces have one unfortunate feature in common: they are expensive. While cost may not be a barrier to larger institutions, it can be prohibitive for smaller and rural libraries. By using open-source software and components that are easy to purchase in bulk or at wholesale prices, we can create a smart classroom that is significantly less expensive to install than existing options. Lower-cost smart classrooms open the door for more institutions to utilize this valuable learning tool.

Moreover, many existing smart classroom designs require dedicated spaces that must be set up in specific ways before technology can be installed. By contrast, the design of our smart classroom kit will allow it to be installed easily in small or oddly shaped spaces with little existing technological infrastructure. Its modularity will permit it to be moved easily to spaces where it is needed, making it accessible to larger audiences. Therefore, although smart learning space technology itself is not new, the implementation will be innovative because it will provide increased access for institutions and students that have been left behind.

Project Design

What are the goals, projected outcomes, and assumptions of your project?

For students, the goal is to provide learning experiences that are otherwise not possible or are difficult to obtain in a traditional classroom without access to new technologies. This goal has three outcomes:

- Outcome: At least 70% of demonstration attendees will indicate that the smart classroom kit increased the quality of their learning experience.

- Outcome: At least 70% of demonstration attendees will indicate that the platform offers learning opportunities that traditional classrooms cannot provide.
- Outcome: At least 70% of demonstration attendees will indicate that the platform increased their understanding of the information taught.

We assume that attendees will be willing to complete a survey after participating in sample programming.

For libraries, the goal is to provide a less expensive, portable alternative to traditional smart learning spaces that will allow smaller and rural institutions to offer programs, events, and exhibits that are otherwise cost prohibitive. This goal also has three outcomes:

- Outcome: The setup cost for the smart classroom will be less than $500 for libraries that already own the necessary equipment.
- Outcome: The setup cost to purchase the entire smart classroom kit will range from approximately $14,000 for a simplified version to $25,000 for a full complement of equipment.
- Outcome: The time required to set up the smart classroom kit will be less than two hours, with teardown time less than one hour.

We assume that libraries will be able to locate vendors for the required kit components and that they will have the necessary staff to assemble the kit.

What are the potential risks to the project and are they accounted for in the work plan?

Project risks are minimal. There is a risk that implementing the smart classroom space will prove more expensive than expected. We will minimize this risk by working closely with our consultants and institutional technology services staff. In addition, we will separate the final list of kit components into required and optional categories so that the cost will be scalable depending on libraries' means.

While we are confident about the hardware and equipment necessary to run the smart classroom, the software implementation may prove more challenging than we expect. To minimize this risk, we will modify existing software packages rather than attempting to write new software specifically for the smart classroom.

There is also a risk that we may experience lower than expected participation in our test programming. We will minimize this risk by working with Forsyth Library's dedicated Outreach Services Specialist to advertise test programs via social media, email, posters, and newsletters.

How are project activities informed by appropriate theory and practice?

In addition to our literature review on smart spaces and connected learning, we will conduct a series of focus groups consisting of librarians from varying sizes and types of institutions. We will seek their input on what types of equipment and functionality would be useful and their feedback on the prototype of our portable smart classroom kit. We will also work with advisors who have experience in designing connected learning spaces. A consultant from the Wichita Exploration Place, Laurel Zhang, will assist with prototype design and sample programming while Kristin Fontichiaro, from the Michigan School of Information, will work with us to tailor the smart classroom design to the needs of small and rural libraries.

When and in what sequence will activities occur?

We will conduct the project in three phases: first, the planning phase, scheduled from October through December 2018; followed by the development phase, from January through May 2019; and then the documentation phase, from June through September 2019. We will track the progress of the project using a Gantt chart and quarterly reports to the FHSU University Library Provost Standing Committee, as we do for the

Forsyth Library's strategic plan. An advisory group of librarians from diverse institutions, described in more detail below, will provide the input and feedback to help us adjust course when necessary.

The Planning Phase, October – December 2018

Although we believe the smart classroom kit could also be impactful in K-12 schools and public libraries, we will focus on academic applications due to the limited time frame. We will begin the planning phase by bringing together an advisory group of potential smart classroom users including librarians at FHSU, the University of Nebraska at Kearney, the University of Kansas, Kansas State University, Pittsburg State University (pending letter of commitment), Dodge City Community College, Johnson County Community College, and Labette Community College.[i] This group covers a broad range of academic library types, including research universities, regional comprehensives, and community colleges. The advisory group will be involved throughout the project, making decisions about the design of the smart classroom kit and providing feedback on the prototype, sample programming, and documentation.

With prior FHSU IRB approval, the advisory group members will meet in virtual focus groups, initially to discuss desirable design features and functionalities for the smart classroom kit and on a continuing basis as needed throughout the development and documentation phases. We will provide the group with background information about similar projects and potential technology that could be incorporated into the prototype. We will build a simple 3D mockup in SketchUp that can be edited in real time during the focus groups based on attendees' suggestions. The use of focus groups to plan new library spaces and services is well established in library theory and practice as a means of facilitating complex decision-making and understanding the motivations and emotions behind stakeholders' opinions (Case & Given, 2016, p. 245; Powell & Connaway, 2010, p. 173).

The Development Phase, January – May 2019

In the development phase, we will build a low-cost modular smart classroom kit. The kit will be designed based on the advisory group's feedback and consultations with Laurel Zhang, Director of Special Projects for the nationally recognized Exploration Place (Wichita, KS), and Kristin Fontichiaro, Clinical Associate Professor at the University of Michigan's School of Information. Ms. Zhang and another member of her staff will participate in feedback processes and help design educational applications for the smart classroom platform based on their experiences with interactive exhibits. They will travel to FHSU for four days in February to provide hands-on consulting. Ms. Fontichiaro will interact with the project team by email and monthly conference calls for the first half of the project. In April or May she will travel to FHSU for four days to consult with the project team about the needs and interests of small and rural libraries, data from focus groups, and other needs that arise during the design process.

We will build the prototype by using open source software and components that are easy to purchase in bulk or at wholesale prices, such as rolls of projection fabric instead of traditional screens, to keep costs down. Implementing the kit will be an iterative sequence: design, implement, test with advisory group, repeat. By having stakeholders available at all stages, the process will be purposeful yet efficient. Once the kit is complete, we will work with our advisory group to develop and demonstrate use cases in data visualization and virtual reality. The kit's portability will allow us to easily test its effectiveness in multiple different locations.

Once we are confident that the prototype works as intended, we will design a one-hour sample training module for librarians who will use the room. This training will also be available to our focus group members who express an interest in attending. After the training module, we will administer a survey asking how

confident the attendees feel in using the smart classroom technology and what changes, if any, they would suggest to the user interface.

The final step of the development phase will be to offer sample programming in the modular smart classroom to demonstrate its different uses and to verify that it is pedagogically effective. We will test the smart classroom technology in the FHSU Forsyth Library with faculty and student volunteers from a variety of academic disciplines. Among the digital objects that we have available for sample programming are:

LiveStock 3D: Employs virtual reality tools to articulate and visualize the reproductive and other bodily functions of cows. The software allows the user to select, highlight, and learn about each relevant part of bovine anatomy. The 3D model can be rotated, zoomed, or opened layer by layer.

X-Ray Brain: It is nearly impossible to demonstrate each of the various parts and connections inside the brain with a 2D illustration or even a video. This project leverages 3D virtual reality tools and data from an actual MRI scan of a human brain to create a truly interactive platform for learning about each part of the brain.

3D Chemistry: Molecular structures can be interactively created and modeled allowing students to bring the nano-scale up to the size of a room. An advanced version of this project would allow students to step inside of the chemical processes inside bodies, machines, and outer space.

Virtual Library: Using virtual reality and video game equipment, this immersive and highly accurate 3D model of Forsyth Library is used to drive an exploration tool, scavenger hunt, and emergency evacuation drill. The system is also a prototype of a wayfinding system capable of providing Google Earth style walking directions in 3D virtual spaces directly to a book on the shelf.

Tiger Range: This large scale virtual reality platform produces interactive models of the university campus and investigates the processes through which these models can be efficiently and cost-effectively built. The 3D model of campus is useful for wayfinding systems, facilities, planning, recruitment and retention, and marketing.

We will also put on a digital exhibit featuring FHSU's historical Plymouth Schoolhouse, for which we already have digitized artifacts and a 3D model. Once we have tested the prototype at FHSU, we will take it on the road to the University of Nebraska at Kearney, Pittsburg State University, and the Wichita Mini Maker Faire at the Exploration Place. This will allow us to get feedback from students and librarians at other institutions and from the technologically inclined public as a whole.

The Documentation Phase, June – September 2019

Based on our iterative design and testing, we will write user-tested documentation on both the kit itself and its possible applications to be disseminated with the kit and assembly instructions. The core of the documentation will be the list of required and recommended kit components based on input from our advisory group and prototype. We will also include assembly instructions based on our experiences setting up, tearing down, and transporting the prototype as well as on feedback from non-technical staff.

The documentation on possible applications will contain suggestions for possible program and event uses and for assessment techniques based on our experiences providing and assessing sample programs and exhibits at FHSU and on the road. We will create a pedagogical and technical training manual based on the challenges and successes that we encounter while testing the prototype. We will also disseminate the results of the project via a journal article, conference presentations, listservs, and webinars. Our dissemination plan is described in more detail below in the National Impact section.

How does the project design allow for input, consensus building, and buy-in from others inside or outside the field? If the project involves working with the community/public, how will their perspectives and contributions incorporated in to the project design?

Our initial focus groups on the smart classroom kit's design, components, and functionality with librarians from various types of institutions will provide input from others in the field. The focus group discussions will allow us to build a consensus for the initial design rather than collect individual opinions gathered through other avenues such as surveys. We will also seek feedback from our advisory group throughout the prototyping process in order to have a consensus on the design before we begin offering sample programs and exhibits. We will build buy-in from others in the field by offering prototype training and taking the kit on the road to other institutions.

As we offer sample programs and exhibits at FHSU and other institutions, we will collect input from students, our primary target audience, through assessment during programming and post-event surveys. We will also experiment with other face-to-face assessment methods, such as quizzes and think/pair/share, to measure student learning during the sessions in order to be able to offer recommendations to other libraries. This input will be incorporated into the final version of the prototype and documentation for the kit. Since public perspectives will be important for future applications of the kit in public libraries and museums, we will seek input from the public via our excursion to the Wichita Mini Maker Faire.

Who is the audience for the project and how will they participate?

The primary audience that will benefit from our project is underserved college students at small and rural academic libraries. FHSU is located in rural Hays, Kansas, an underserved community regarding access to new technology, and many of our students come from rural high schools without access to connected learning spaces. Our students are an ideal audience for sample programming and testing using the smart classroom kit prototype. They will experience new learning methods and provide invaluable feedback by participating in our sample events.

Other academic libraries of varying types and sizes will participate in the project through the focus groups and by providing feedback on the iterative design process. Their involvement will allow us to design our smart classroom around the needs of their students as well. Although we are focusing on academic libraries for our project, we envision that the smart classroom kit would also be impactful for students of other age groups and at other types of institutions nationwide, such as public libraries and museums.

If applicable, what are your plans to meet the needs of underserved communities? How are those needs assessed and those communities involved in creating and implementing parts of your work plan?

FHSU is a Carnegie basic masters-level institution with several academic departments offering masters-level graduate degree programs. The university is located in rural Hays, Kansas and primarily serves the western half of Kansas, eastern Colorado, northwest Oklahoma, and southwest Nebraska. 77.38% of our Kansas resident students come from counties considered as "rural" (population density between 6.0 to 39.9 persons per square mile) or "pioneer" (population density of less than 6.0 persons per square mile).[ii] Nearly 35% of our on-campus undergraduate students receive Pell grants and many are first-generation college students. FHSU is a prime institution for this type of work because the school enjoys the capabilities of graduate research programs while serving a traditionally underserved population. Through our focus groups, we are also working with other small and rural academic libraries to assess the needs of their students.

The project will meet the needs of these underserved students by providing access to new technologies that is currently lacking in their home communities and at the small and rural institutions where many of them attend college. Access to new technologies in higher education is critical for preparing students to encounter

them in the workforce. In addition, connected learning provides opportunities for students to learn critical skills such as data literacy and spatial reasoning.

Who will plan, implement, and manage your project?

The Project Manager and Principal Investigator is Claire Nickerson, Learning Initiatives and Open Educational Resources Librarian at FHSU Forsyth Library. Claire is on the Teaching and Research Team and works closely with faculty to implement open educational resources in the classroom, including media such as videos, simulations, and interactives. In addition, she provides research assistance to students and faculty and teaches information and digital literacy instruction sessions. Claire holds an MLIS and a certificate in Digital Humanities from the University of California, Los Angeles, where she worked on a 3D simulation, presentation, and exhibit software called VSim. She is familiar with technologies for data visualization and digital collaboration.

The Co-Principal Investigator is Gordon Carlson in the Department of Communication Studies and the Institute for New Media Studies at FHSU. Gordon holds a PhD in New Media Communication from the University of Illinois at Chicago, where he served in the Electronic Visualization Lab. He has researched and published on pedagogy, formal and casual learning, and virtual/augmented reality approaches to learning.

The Co-PIs will plan and implement the project with collaborative support from FHSU and external institutions. The FHSU Forsyth Library has a dedicated Outreach Services Specialist and Administrative Assistant who will help with the logistics of organizing and promoting sample programs using the smart classroom kit prototype. The project team will also collaborate with an advisory group and two consultants throughout the various phases of the project.

What time, personnel, financial, and other resources will you need to carry out the activities?

We seek funding to cover a partial course release for Gordon Carlson, the Co-PI, which will combine with his dedicated research time to provide the flexibility to carry out the grant activities. Since Claire Nickerson, the PI, is responsible for learning initiatives within the library and is part of the Learning Commons Council (the library's internal committee on library spaces), grant activities will fit within her normal work schedule. Undergraduate student assistants will participate in constructing prototypes, conducting research and data gathering, and designing programming.

We will work with personnel from other libraries as an online advisory group and with two consultants, Laurel Zhang of the Wichita Exploration Space and Kristin Fontichiaro from the Michigan School of Information. Each of our consultants will visit FHSU for four days during the development phase in spring 2019. We will also take our smart classroom kit prototype on the road to two of our partner institutions and to the Wichita Mini Maker Faire. Funding is requested to cover the travel costs involved.

Other requested financial resources will cover materials, supplies, and equipment necessary for building and modifying the prototype. We have constructed a list of likely components based on a literature review of previous smart classroom implementations and a tentative design concept,[iii] but the exact equipment and specifications are subject to change based on input from our advisory group. Should the advisory group request functionality or components that are beyond the scope of the grant funding, we will include them as optional additions to the materials list in the kit documentation.

How will you track your progress toward achieving projected goals and intended outcomes? How will you include evaluation and performance measurement in your plan?

We will track our progress toward achieving projected goals and intended outcomes using a Gantt chart and quarterly reports to the University Library Provost Standing Committee and to the IMLS to ensure that the project is on track. The on-campus project team members, including the PI, Co-PI, student assistants, and

support staff, will meet every two weeks to assess progress. We will also meet virtually with our advisory group members and consultants on a regular basis. Reports and project files will be maintained on university-owned and controlled servers that are regularly backed up and protected by alternate power sources and monitoring. For Omeka digital exhibit projects, such as our Plymouth Schoolhouse exhibit, built-in versioning tools will allow us to track changes in real time. All public-facing documentation will be posted in the FHSU Scholars Repository.

As we build the smart classroom prototype based on input from our advisory group and consultants, we will track the expense to purchase the equipment in order to ensure that it is low cost and take note of potential suppliers. After we build the initial prototype, we will provide test programs and exhibits both at FHSU and at other institutions. At these demonstrations, we will administer assessment surveys to attendees in order to determine whether the smart classroom kit added to their learning experience, offered opportunities that traditional learning spaces do not, and increased their understanding of the material presented. These demonstrations will also provide an opportunity to time the setup and teardown process and determine the most efficient methods for moving the kit.

How and with whom will you share your project findings? How will results of the project be made available?

We will post the smart classroom kit documentation and a project case study in the FHSU Scholars Repository under a Creative Commons license. The repository is part of the Digital Commons Network, indexed by Google Scholar, and is therefore easily accessible to other academic libraries that seek more affordable smart classroom options.

We will advertise the kit by publishing a summary of the project in a journal devoted to academic libraries, such as the *Journal of Academic Librarianship* or *College and Research Libraries*. We will give presentations at national library conferences such as ALA Annual or the Association of College and Research Libraries conference. We will also post the project to the listserv for the ALA's Association of College and Research Libraries (ACRL) and provide at least one webinar on the project through ACRL, the Library Information Technology Association (LITA), or other platforms not specific to libraries. To reach broader audiences, we will submit a proposal to present the project at the National Forum to Advance Rural Education.

Diversity Plan

Who are the diverse or underserved communities that will be served by this project and how were they identified?

As noted in the Organizational Profile, Fort Hays State University (FHSU) is the only university in western Kansas, serving students from the rural regions of western Kansas, eastern Colorado, northwest Oklahoma, and southwest Nebraska. Many of these students come from schools where they do not have access to libraries or librarians, let alone library instruction on data literacy or spatial reasoning using new technologies. As of the 2015-2016 school year, there were only 688 certified library media specialists working in all of Kansas's 297 school districts, mostly in large urban areas (Snyder, 2017). Additionally, many rural communities are too small to have public libraries, which means that many of the students and community members FHSU serves do not have access to advanced technologies. The smart classroom kit will provide access to these technologies in Hays and in similar rural communities across the nation at a much lower cost than traditional smart learning spaces. In addition, its portability will allow it to serve multiple constituents within the same communities conveniently.

What are the unique needs of the community members that will be served by this project?

The primary audience for the project is community college and university students who are in or hail from rural areas. Since many of these students come from communities that are underserved in regards to new technologies and access to libraries, they may not have previously encountered smart learning spaces. Therefore, the portable smart classroom kit meets their needs by enhancing equity and access to connected learning. It enables these students to catch up on skills that they may not have had the opportunity to develop in their home communities, such as data literacy and visualization and spatial reasoning. It also promotes digital inclusion by permitting them to experiment with new technologies that they may encounter in the workforce.

The secondary community that will be served by our smart classroom kit project is small or rural academic institutions that may be eager to move into the connected learning space but not have the means to do so in a traditional manner due to limited funding. The kit will enable them to provide connected learning technologies at a lower price, in spaces that are not equipped for traditional smart classroom installation, and to share one kit between multiple buildings or campuses. This further increases the kit's flexibility and reduces costs by avoiding the need to duplicate services.

How will the proposed project address the needs of those communities? How is the community involved in defining the needs and in the implementation of the project?

Because the smart classroom kit will be low cost, it will enable smaller and rural institutions that have been left behind in terms of connected learning space adoption to install smart classroom technology affordably. Affordable smart classroom technology is impactful because it promotes data literacy for students who might otherwise lack access. Because the kit will be portable, libraries will also be able to take it to constituents outside of their walls.

By drawing focus group members from small and rural institutions, we are involving the community members that will be served by the project in defining their needs. We will also seek feedback on the prototype smart classroom kit throughout the iterative design and testing process, involving constituents in the implementation of the project.

National Impact

How might your project scale, transform practice, or otherwise lead to systemic change within the community and at the national level?

Historically, smart classroom technology has been limited to institutions with large budgets and recently constructed or remodeled spaces. For other institutions, teaching data literacy and spatial reasoning or offering interactive 3D programs and exhibits using this technology has been unattainable. Our portable, modular smart classroom kit will bring that technology within the reach of smaller institutions across the nation. This attainability will be particularly impactful for rural students who might not otherwise have access to new technologies or connected learning. The kit's portability will enable it to serve multiple constituents within the same community, while its modularity will make it inexpensive to upgrade and contribute to a long lifespan.

What are the findings or products from this project that will benefit multiple institutions and audiences?

The deliverables for the project will include a list of required and recommended kit components, assembly instructions, a training manual, and suggestions on how the smart classroom can be used for library instruction, events, and exhibits. These deliverables will be impactful for multiple institutions, not only in our service area, but around the nation. Although we are focusing on academic libraries, other types of libraries and museums could benefit as well. Our kit will enable any institution to set up and begin using smart

classroom technology with little financial investment or setup time, similar to the One Button Studio project created by Penn State (2016). Our advisory group members from other institutions will help to ensure a large impact, as they are likely to adopt and advertise the kit as well.

How will you ensure project products are readily adaptable to other institutions and communities?

Our list of required and recommended smart classroom kit equipment will be scalable so that institutions and communities with limited budgets can get started regardless of their means. Moreover, since we are receiving input on the design and uses of the kit from many different sizes and types of institutions, its functionality will be diverse. The kit documentation will include suggestions on how to adapt it for various types of events and exhibits appropriate to other institutions.

Referring to the Performance Goal(s) and Performance Measure Statement(s) selected on the Program Information Sheet prepared for your application, how will you collect and report the corresponding data?

Our project primarily addresses the IMLS's agency-level learning goal by training and developing library professionals to use smart classroom technology, supporting communities of practice around connected learning, and developing and providing inclusive and accessible learning opportunities related to data literacy, new technologies, and spatial reasoning. We will collect input from library professionals and communities of practice via our initial focus groups and surveys during the iterative design and testing process. We will assess student learning and opinions through feedback surveys at each of our sample programs and exhibits. This data will be included in the case study, journal article(s), conference presentation(s), and webinar(s) as part of our dissemination plan.

What are the benchmarks for the project's performance measures? How will you measure success with these benchmarks?

Train and develop museum and library professionals:

- We will solicit input from library professionals from a cross-section of institution types through our initial focus groups, providing an opportunity for staff with existing expertise in this area to network and expand their knowledge. We will measure our success based on the creation of a mutually agreed-upon list of desired components and features for the smart classroom kit.

Support communities of practice:

- We will build the smart classroom prototype and measure success based on low cost, portability, and positive feedback on the design from our advisory group members.
- We will put on sample programs and exhibits using the smart classroom kit prototype and measure the kit's ease of use based on feedback from our advisory group partners and librarians.

Develop and provide inclusive and accessible learning opportunities:

- We will administer surveys to participants of our sample programs and exhibits and measure success based on reports of positive learning experiences and new skills learned.

References are included as a supporting document.[iv]

[i] See letters of commitment, supporting documents #1-6

[ii] See map of Kansas population density and advisory group member location map, supporting document #7

[iii] See tentative design concepts, supporting document #8

[iv] See references, supporting document #9

Schedule of Completion

The Modular Smart Classroom: Anchoring Communities with Interactive Learning Spaces

Start: October 1, 2018 Finish: September 30, 2019

Our schedule is broken into three phases. (1) The planning phase includes IRB approval for studies, background research, equipment purchases, and initial input from stakeholders in the form of focus groups. (2) The development phase includes building a prototype based on input from our advisory group and consultants and feedback from sample programming at FHSU and other institutions. (3) The documentation phase includes finalization of instructional documents and training materials, dissemination, and completing the final report for the IMLS.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Planning Phase												
Submit IRB application for focus groups	x											
Hold focus groups with librarians from other institutions	x	x										
Adjust prototype plan based on feedback from focus groups		x	x									
Begin purchasing required materials		x	x									
Development Phase												
Build initial prototype				x								
Iterative testing and development cycle				x	x	x	x	x				
Exploration Place visits FHSU to participate in feedback, contribute to iterative design, and assist in program development					x							
Fontichiaro visits FHSU to consult, participate in feedback, and develop programming							x	x				
Take the prototype to the Wichita Mini Maker Faire							x					
Test programming in the prototype, both at Forsyth Library and at other locations							x	x				
Documentation Phase												
Work on documentation and training materials									x	x		
Target dissemination of results for publication/presentation											x	x
Complete report for IMLS												x

DIGITAL PRODUCT FORM

Introduction
The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded digital products (i.e., digital content, resources, assets, software, and datasets). The products you create with IMLS funding require careful stewardship to protect and enhance their value, and they should be freely and readily available for use and re-use by libraries, archives, museums, and the public. However, applying these principles to the development and management of digital products can be challenging. Because technology is dynamic and because we do not want to inhibit innovation, we do not want to prescribe set standards and practices that could become quickly outdated. Instead, we ask that you answer questions that address specific aspects of creating and managing digital products. Like all components of your IMLS application, your answers will be used by IMLS staff and by expert peer reviewers to evaluate your application, and they will be important in determining whether your project will be funded.

Instructions

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

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

Part I: Intellectual Property Rights and Permissions

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

Fort Hays State University (FHSU) will be the copyright owner of digital products created with funding from the grant. Digital products will be made available for use and re-use with a Creative Commons license (Attribution-NonCommercial-ShareAlike 4.0 International). This license allows others to remix, tweak, and build upon the work for non-commercial purposes, thereby enabling broad adaptation by libraries, archives, museums and other public entities while attributing the original work to FHSU. Online content, including web pages and the data visualization "kit" documentation will feature the CC license notice with a link to the license terms.

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.

FHSU will make downloadable digital products permanently available through its on-line institutional repository hosted on the Digital Commons (bepress) platform for discovery, access, and use. Terms of access and use will be included in the metadata for the repository and will be consistent with the Creative Commons license (Attribution-NonCommercial-ShareAlike 4.0 International). FHSU will hold copyright with the only restrictions being attribution and non-commercial use as noted in A1.

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.

These concerns do not apply to this initiative.

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

A. Creating or Collecting New Digital Content, Resources, or Assets

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

The smart classroom platform will allow instructors or presenters to share information with learners in formal (such as a university classroom or library educational program) and informal settings (such as a museum). The platform is designed to allow for existing educational data or collections to be used by leveraging open source and tools and file formats compatible with off-the-shelf software. Rather than create new software, this project will help users construct and make use of pedagogically-driven information and visualizations. This can include compatibility with software such as: Omeka, Open Exhibits, SAGE, Scalable Adaptive Graphics Environment (SAGE and SAGE2), SketchUp, Unity3D, Blender, Maya.

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.

Software for creating pedagogical packages and learning modules include Omeka, Open Exhibits, and Unity3D. In support of creating these packages, the project team will leverage Omeka, Open Exhibits, and Unity3D themselves in addition to Microsoft Office programs, Adobe design programs, SAGE/SAGE2, Blender, Maya, SketchUp, SAS/SPSS for statistical computations.

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).

Documentation for the kit will be in PDF format. When possible, materials created for display in the smart classroom will use TIFF and PhotoShop with uncompressed PNG files used as a backup and standard to work with any outside systems. Information will be stored in XML or HTML formats. Content created by others and integrated into the project (such as pedagogical units already created and freely available for reuse) may rely on other formats such as JPEG, PDF, or Microsoft Office products. The highest and most readily archived formats will be used when these situations occur.

B. Workflow and Asset Maintenance/Preservation

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

Project files will be maintained on university-owned and controlled servers that are regularly backed up and protected by alternate power sources and monitoring. For Omeka projects, versioning tools are built in that allow us to track changes in real time. For Microsoft Office products, SharePoint and university servers will be used to maintain versioning. For other components, regular meetings with project team members, a content versioning system (when applicable), and a consistent data management strategy on university servers (in concert with university IT professionals) will protect project results and allow for easy tracking of progress and quality.

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).

As noted previously, all digital assets will be made permanently available for open access through the university's institutional repository. http://scholars.fhsu.edu/

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).

Metadata applies only in a very limited context to this project in describing the documentation produced for the data visualization "kit." This documentation will be deposited in the institutional repository in Dublin Core format.

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

Metadata, as explained in C.1, will be preserved in the university institutional repository.

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).

OAI-PMH will make project documentation metadata available to search engines.

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).

Project components will not be available to the public during the initial development phase. Once components are ready in either a "complete" status or "draft seeking input" status, they will be initially posted to a project website hosted on university servers and be publicly available. Pedagogical content created or adapted, instructions for using the prototype, design schematics/implementation instructions, and white papers outlining results and suggested best practices will all be available on the website. Once these items are considered "complete" (which does not mean they could not still change if project progress merits) they will be permanently added to the FHSU Scholars Repository for systematic categorization and public access.

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.

FHSU Scholars Repository - http://scholars.fhsu.edu/
FHSU Digital Collections @ Forsyth Library - http://contentcat.fhsu.edu/cdm
FHSU Omeka Exhibit, Plymouth Schoolhouse - https://plymouthschoolhouse.omeka.net/

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?