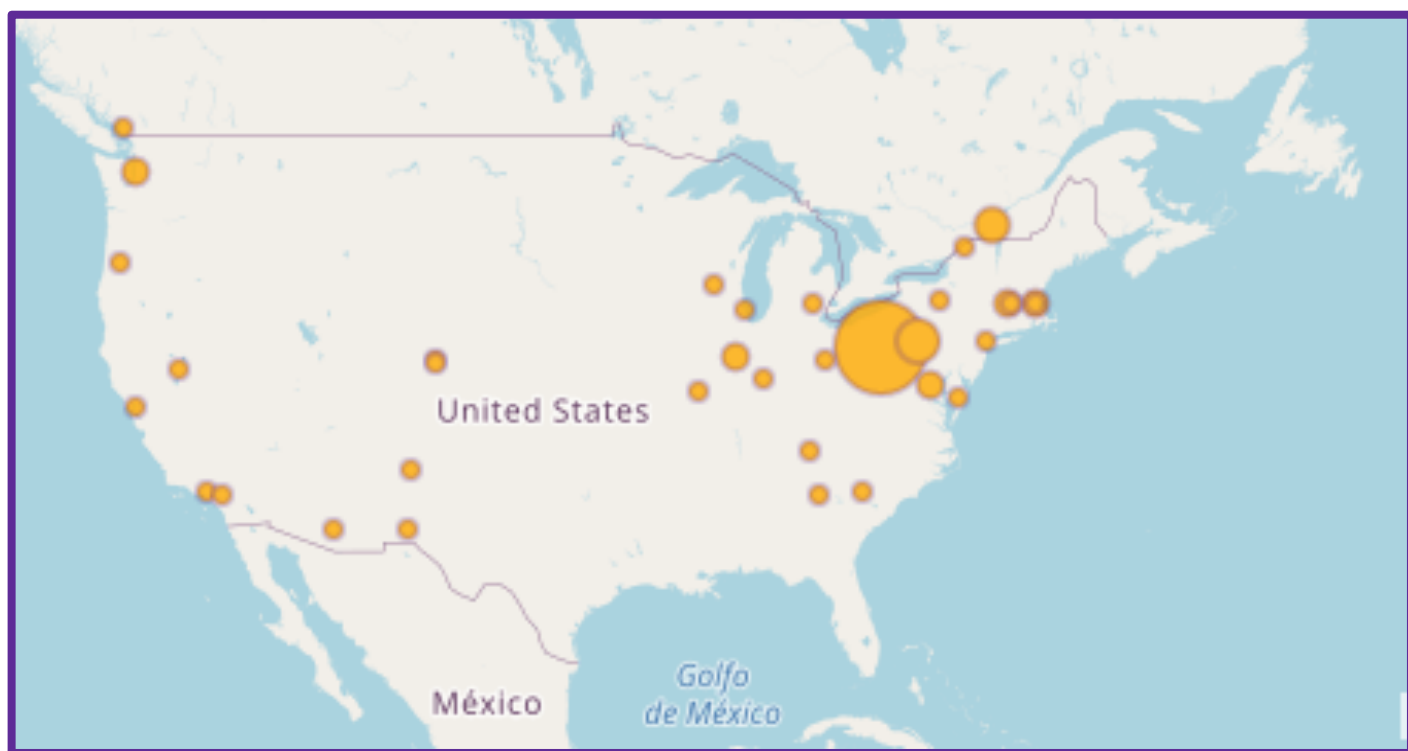# The Role of Libraries in Geography and GIS Education:
a report on conversations about libraries, geography, GIS and education

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Image on the front. Map of cities where people who attended our sessions work: referred to in the report as Figure 1. Our conversations included over 50 people, mostly library employees, from across the US and a few from Canada and Spain. Locations sized by participant count.

Executive Summary

Libraries have long acted as a source for accessing knowledge as well as building student skills in research and critical thinking. With the development of GIS software, which has proved instrumental to a growing number of disciplines, it is clear knowledge of spatial data and map literacy are key factors in student and civic learning and research. Today, the growing ubiquity of both proprietary and open source tools for making maps and conducting spatial analysis put these tools easily in the hands of anyone with access to a computer and the Internet. Thus, the charge of libraries to facilitate the literate use of these tools and a firm socio-contextual view of spatial datasets is paramount.

The goal of this project was to bring together people who work in libraries, educators, and data practitioners to create a network of people to discuss geography and GIS education in libraries and other informal learning environments. In recent years, geography and GIS educators have increasingly focused on the basic principles of spatial literacy, or the ability of people to read, understand, and reproduce or utilize geographic data. Over the course of the project, we hosted 11 conversations with geo-educators across the US (mostly over Zoom) and this report includes many of the issues and practices we heard about in those conversations. Each conversation included guiding questions that were used to generate conversation but we also left space open for the conversation to evolve and participants to ask their own questions.

Over the course of the project, we identified four high-level takeaways that are referred to directly or tangentially throughout this report. These include: There are no set rules for Geo-educators in informal settings, the need for spatial literacy and mapping support is growing, instruction is a key component of library geo-education offerings, and there is still a lot we have to learn from each other. We hope to use the identification of these key themes as a base for a new geo-educator community of practice.

About this project

The **Role of Libraries in Geography and GIS Education**, a.k.a. ROLGGE (pronounced "Role G"), is a grant funded project to foster the development of a community of libraries, data practitioners, and educators to enable effective teaching, consultation, and outreach around spatial literacy education.

Funding for the project was awarded by the **National Center for Research in Geography Education** (NCRGE) as a Transformative Research in Geography Education grant. The funds from the project were dedicated to network building activities like in-person and virtual meetings. The original grant is a National Science Foundation grant that was distributed over several years to form multiple networks.

The project was organized by Emma Slayton and Jessica Benner who work in the Libraries at Carnegie Mellon University. Over the course of the project, we hosted one in-person meeting, eight virtual meetings via Zoom and two virtual conference sessions. Some of our in-person activities were cancelled due to the COVID-19 pandemic.

Dr. Emma Slayton serves as a Data Curation, Visualization and GIS Specialist at the Carnegie Mellon University Libraries. For her PhD, Emma used GIS based analysis and computational methods to analyze pre-historic seafaring in the Caribbean. This fit well with her interest in telling spatial stories around human mobility and interaction in the past. In addition to her work with GIS, Emma is trained other visualization methods (such as ggplot and Tableau) and enjoys her role as an advocate for visualization best practices around the university, eslayton@andrew.cmu.edu.

Dr. Jessica Benner serves as a Liaison to Computer Science and a GIS Specialist at the Carnegie Mellon University Libraries. She is interested in understanding the motivations for collaborative mapping projects like OpenStreetMap and how these tools are used to map the physical accessibility of urban spaces. During her PhD work she studied the concept of physical accessibility in indoor and outdoor spaces. She continues this work by collaborating with people around the city to generate data describing the accessibility of our neighborhoods, jbenner@andrew.cmu.edu.

Introduction

The goal of this project was to bring together people who work in libraries, educators, and data practitioners to create a network of people to discuss geography and GIS education in libraries and other informal learning environments. Best practices in geography and GIS education (for all age levels) are still being developed, particularly in terms of pedagogies for building spatial literacy. Much of this practice has been focused on working with individuals in K-12 education (ex. Chang and Kidman 2019; Collins and Mitchell 2018; Kirchberg 2000; Mitchell 2017). We know that libraries can support the development of pedagogy, research in geography education and actually teach people of all ages about geographic practices, maps, data and spatial information. Furthermore, these activities can be connected to educational efforts occurring within the K-12 or college classroom. At their core, all libraries are cultural heritage institutions that support education, research and civic life within a community. Libraries act as a stronghold for education on spatial literacy and critical engagement with geographic concepts in the following ways:

1. Libraries are connection points to help people (community members and students) learn about spatial concepts and geospatial tools.
2. People encounter geospatial tools in their daily life on a wide scale but they are often unprepared to engage with or use these technologies in critical ways.
3. Libraries are spaces that can be used to:
   ● Teach about spatial concepts (one-off, series or full courses)
   ● Consult with and support individuals in their existing and emerging projects
   ● Outreach to a variety of communities about geography concepts and the role of geography in society

In recent years, geography and GIS educators have increasingly focused on the basic principles of spatial literacy, or the ability of people to read, understand, and reproduce or utilize geographic data. Both university and public libraries have long engaged in workshops focused on general mapping knowledge, tool training, and archiving of spatial data. Libraries are uniquely situated to act as a springboard for teaching spatial literacy and critical engagement with geographic concepts, in part because these institutions serve a wide swath of the population, even beyond traditional geography programs. This includes students from a multitude of disciplines within a University / k-12 institution served by school libraries and the broader community served by public libraries. Libraries can act as a base-station to help people learn about spatial concepts and geospatial tools in multiple contexts. In many cases these institutions focus on tool training practices that might otherwise be ignored.

We had three main objectives in this project. First, we aimed to bring people together into a research network focused on GIS, Libraries and Education. Next, we hoped to initiate a repository of reusable pedagogical materials that people working in libraries and other informal educational spaces can reuse when teaching people about geographic concepts and GIS tools. Lastly, we wanted to gain a general understanding of the landscape of informal spatial education happening in libraries and other informal learning spaces.

This work was funded by the National Center for Research in Geography Education, a research consortium for transformative research in geography education. NCRGE's (www.ncrge.org) mission is to build capacity for research that advances theory, deepens knowledge, challenges thinking, and supports evidence-based practices in geography education. Our funding supported the development of a network of people focused on the role of libraries in geography and GIS education by bringing people together in conversation about our shared practice. Our focus for the year was to generate conversations with as many people as possible about libraries, GIS and education. We began with a local conversation with people in and near Pittsburgh, PA, our home base, then organized two virtual sessions at the 2020 American Association of Geographers conference, and finally, held eight informal virtual conversations using Zoom, four in April 2020 and four in September 2020. We intended to co-host a symposium with our colleagues at the Penn State University Libraries but the COVID-19 pandemic prevented it from occurring this year.

[our orientation and assumptions] We felt that training in geography and GIS education, especially in informal settings, needs a more critical, interdisciplinary approach. Libraries can act as a space where the history of geography and the concept of map making can be explored in context. Because libraries serve the community we need to take an interdisciplinary approach. Focusing on spatial literacy (& critical thinking) is broad enough to reach the whole community, instead of constraining our activities to the needs of one department or neighbourhood. We asked how have libraries supported geography education in the past? Libraries provide access to many kinds of information and materials including maps and spatial data. These materials include geographic information, depict specific geographic regions in the world and are created using geographic methods. In efforts to enable the use of materials curated within libraries (and other centers), we provide training on how to not only locate the information/data but often to how to visualize and analyze the information/data. Over the years, this training has evolved along with the latest tools available for researchers. One challenge is the growing number of tools available to manipulate spatial data. Libraries offer workshops to teach their users about spatial data, geographic information systems (GIS) tools, spatial literacy, digital humanities tools, and spatial storytelling. In the libraries. In some libraries, licensing for GIS tools is managed and provided to the university community. Libraries also support geography and GIS education formally by purchasing texts & data, guest lecturing in courses, teaching full courses and community outreach.

The conversations

Over the course of the project, we hosted 11 conversations. None of the sessions were recorded but we took notes and saved chat transcripts from the virtual sessions. We briefly describe the conversations below.

Local in-person meeting in Pittsburgh, PA | February 8, 2020

In February of 2020, we hosted a day of discussions at Carnegie Mellon University. We invited people who worked in academic and public libraries, alternate academic instructors, as well as, community members who teach or work with GIS from across the region. We had 10 participants and we talked about the following six topics:

- What are you teaching and why? What topics do you want to teach in the future?
- If someone is doing a project that involves a spatial component, what kinds of services are they asking for and what kinds of tools are they using/trying to use?
- What kinds of research are you doing, or do you want to do, related to informal spatial education?
- Geography is bubbling up but there is a loss of formal geography education in schools.
- Effective strategies for outreach, role of exhibits etc.
- What kinds of professional development have you engaged in, or want to explore related to spatial literacy or GIS?

We believe that our local conversation could bring together a set of diverse voices. We were pleased to have the director of our vibrant regional data center, the Western Pennsylvania Regional Data Center (www.wprdc.org), who run a series of annual workshops and events focused on data, often including spatial data and CMU Libraries own Research Data Management Consultant (who is also a Geographer). We were joined by a GIS Solutions Engineer from the Allegheny County GIS Office, and one librarian and one principal from different local area high schools. The remainder of us worked in academic libraries at CMU, Ohio State University, Penn State University, and University of Pittsburgh who provide support to researchers and students using GIS and other tools and the National Network of Libraries of Medicine who have a interest in data literacy in general and wondered how they could connect health and spatial literacies.

Figure 2. Participants in our local conversation in February 2020.

American Association of Geographers Conference, virtual events | April 8, 2020

Our second two conversations occurred at a national conference. We hosted two sessions at the American Association of Geographers conference under the title "Role of Libraries in Geography and GIS Education". Here we believed that the audience would largely be people working in academic libraries or geographers and we succeeded in attracting both people working in libraries and geographers to give talks. We had a 25 minute Q&A wrap-up session after two sessions of approximately 1 hour each. The talks show the wide variety of activities happening within libraries:

- **Spatial Education in Libraries**, Emma Slayton and Jessica Benner, Carnegie Mellon University
- **Geospatial Education and Information Literacy: Mapping Concepts to Locate Learning Opportunities**, Joshua Sadvari, Ohio State University
- **GUI-Free GIS Instruction in the Library with Jupyter Notebooks**, Philip White, University of Colorado Boulder
- **Importance of historical landscape: Mapping Bamberg settlers in Greater Poland**, Maria Jankowska, UCLA
- **Time Machine Available -- building an online tutorial for historic air photos**, Chris Thiry, Colorado School of Mines
- **Cooperating Classroom Geographic Information Science/System with Library**, Yuri Kim, Indiana University
- **Demystifying map projections for geography student**, Sarah Battersby, Tableau Software, Fritz Kessler, Penn State University

- **The Evolution of GIS Services in Academic Libraries**, David Cowen, University of South Carolina
- **Geospatial education in Europe: young people learning in informal settings**, Rafael Miguel Gonzalez, Spain
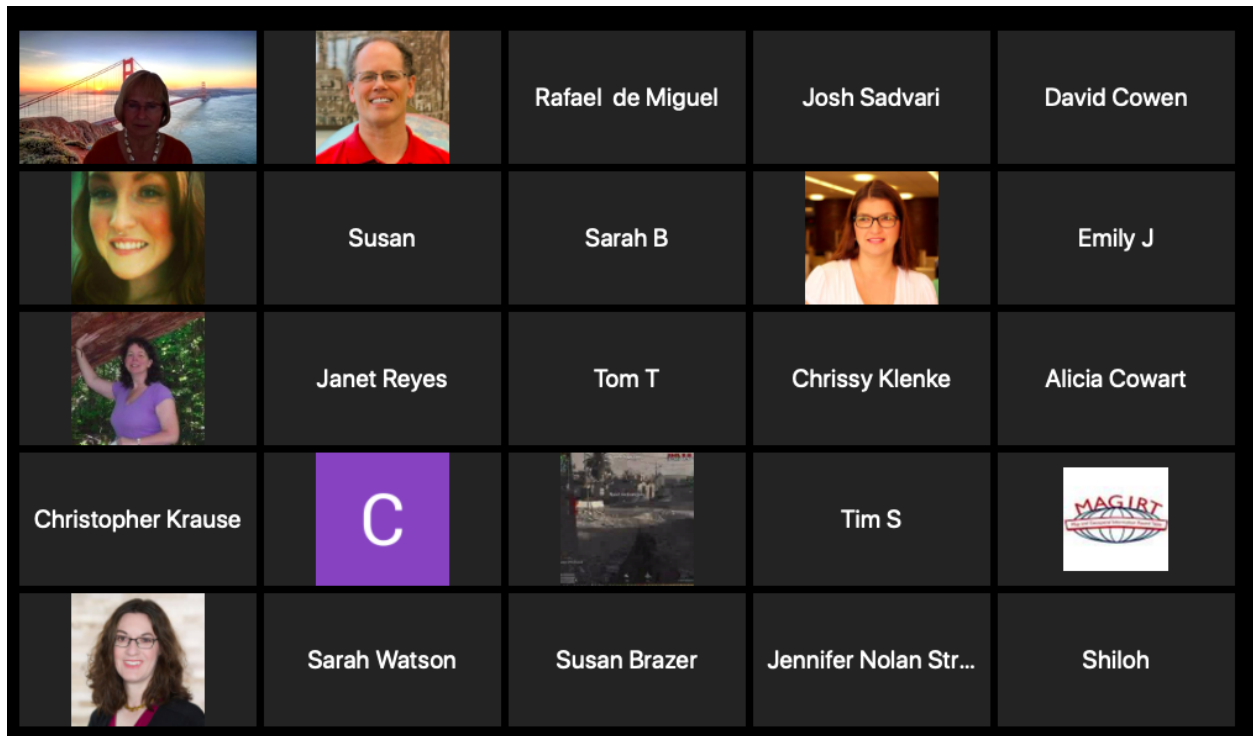

Figure 3. Virtual attendees at one of our AAG sessions in April 2020.

Virtual meetings via Zoom | April and September 2020

As a result of our success at the AAG conference and the reality that COVID-19 would have a long-lasting impact on everyone's ability to congregate, we continued the project via virtual meetings. In hindsight, this has been a boon for the project and it is likely future efforts will be virtual by default to ensure the widest accessibility for participants. We initially designed a set of weekly sessions for the month of April as a one time offering, but due to the success of the first round, we hosted an additional four sessions in September 2020.

These sessions were just one hour meetings on a theme. We posited a guiding question to drive the discussion but left the floor open for participants to ask their own questions or redirect the conversation. Below is a list of our guiding questions:

- April 2020

- ○ What kinds of professional development have you engaged in, or want to explore related to spatial literacy or GIS?
- ○ What are you teaching and why? What topics do you want to teach in the future?
- ○ If someone is doing a project that involves a spatial component, what kinds of services are they asking for and what kinds of tools are they using/trying to use?
- ○ What kinds of research are you doing related to informal spatial education?
- ● September 2020
  - ○ How do we move GIS instruction online? How can we ensure we are meeting pedagogical goals through virtual and remote environments?
  - ○ How do we advocate for open-source / open-access pedagogy (e.g. tutorials, sample datasets) and research (e.g. data sources, data management)?
  - ○ How do we manage collections development (especially in these economically uncertain times)?
  - ○ How can we build and maintain this community? What are the next steps towards supporting our communities interests and needs?

These conversations attracted between 20 and 30 participants each week and often produced rich conversations of issues that are important to the community of folks who are teaching geography and GIS. Participants in these conversations were mainly people working in academic libraries in map collections and GIS centers, specialists, consultants, and librarians, and liaison librarians. We also had people working in public libraries and geographers peppered in the group.

In-person session at PA GIS Conference

We originally planned to host a state-wide conversation with colleagues at Penn State University Libraries that focused on state level collaboration and blended the diversity of the local conversation with the targeted library/geographer audience of the conference sessions. This was postponed due to COVID-19 but we still plan to have the event (eventually) at Pennsylvania's annual statewide PA GIS Conference or in an online forum.

Note on terminology

We are not using the term librarian in our report because it is not representative of our target audience which includes everyone who works in libraries. When referring to our audience, we use the term **geo-educator** to refer to anyone who teaches GIS or geographic concepts in any context (e.g., data centers, any kind of library, local governments, or K-12 schools).

What we learned

This section includes a set of quick takeaways and sub-sections on five areas of emphasis that emerged from our conversations. These are not direct responses to any of the questions we posed in our conversations and some of these areas may intersect one another, but we felt that our participants had distinct things to say about these topics and indicated challenges in these areas that could benefit from further conversation. The subsections are as follows:

- What is the job of geo-educators working in libraries? What skills are needed?
- How do we work with various disciplines and support our communities?
- How do we teach and how do we track our effectiveness in teaching?
- How do we manage our time and develop new skills?

Through a discussion of the role of geo-educators, we noticed our participants were questioning or struggling with similar ideas. These ideas can be grouped into key takeaways, or core concepts, that should be considered when evaluating GIS or Geography education in libraries.

Our conversations revealed the following overarching themes:

1. There are no set rules for Geo-educators in informal settings: We each take our own approach in how to invest and lead the development of geospatial programs, depending on individual and institutional preferences.
2. The need for spatial literacy and mapping support is growing: More than ever, students and researchers from across all disciplines are using spatial information. More is asked of geo-educators to meet, and influence, this growing need.
3. Instruction is a key component of library geo-education offerings: Though styles vary based on individual skill, institutional support, and student engagement, most libraries offer instruction as a service. How we create and disseminate these offerings needs more evaluation.
4. There is still a lot we have to learn from each other: It is clear our community wants and needs to increase communication and collaboration. We need more structured ways to share resources and ideas.

The following sections deal with these key takeaways, each showing that our goals as geo-educators can cross through all aspects of our work.

What is the job of geo-educators working in libraries? What skills are needed?

Conversations about our 'roles' and our 'jobs' came up frequently. The geo-educators who participated in our conversations had a wide range of duties and responsibilities. Some positions focus exclusively on maps, others on GIS and spatial data, some cover both topics and still others balance these responsibilities with other areas such as liaising to academic departments or supporting other tasks like data visualization. This is due in some part to the varied backgrounds of the people occupying these positions, but also, the needs of the external community and the library collections being supported.

Some participants work as part of a department of other map or GIS people while others provide the service solo without any departmental support. Even though GIS has been in libraries for some time, since the early 90s in some cases, more than a handful of participants are the first person in their library to provide support for GIS. We also learned that some geo-educators working libraries are fully dedicated to this work, while others support other areas or services, limiting the time they have to develop and maintain geo-education materials or services. Most participants indicated that they were in a small department or a solo position and for those just starting out, there is a strong feeling that they need to be something akin to a polymath, with at least a deep awareness, of multiple disciplines. This can further extend to the distinction between geo-educators working libraries who have dedicated funding to support physical or digital collections, and those that do not.

This stems from the place of a library within a university campus, city or school. Libraries serve whole communities and when that community is anyone who wants to make a map, find specific spatial datasets, practice spatial data management, learn to use a tool or apply a method specific to their interests, the requirements for the geo-educator are broad. A compounding factor on campuses is the ability to connect with disparate programs and manage the varied expectations of those seeking help.

One geo-educator noted the expectation to publish and present which leads her to have to choose venues where she can present work for academic credit over venues that would be better for maintaining or expanding her GIS skills. Many people who work in libraries struggle to find the balance between activities associated with librarianship and those associated with geo-education. It is not enough for geo-educators to be knowledgeable about GIS, geography and other tools, but we also need to understand trends within libraries and library and information science. Several geo-educators indicated a need for more support from their institution for research activities including research time, grant writing, and general funds for professional development. Many libraries (particularly now due to COVID 19 budget constraints are facing financial constraints that can affect

the number of faculty or staff on hand to support GIS and Geography endeavours and the full support to adequately meet both internal and external expectations of our roles. This issue is often compounded by the fact that library leadership and the general academic community does not fully appreciate the time that goes into developing and maintaining map and GIS services: this may be similar for other types of libraries.

Another challenge facing geo-educators is how to effectively outreach. Several participants expressed a tension between the need to be proactive in marketing their services, and supporting their everyday work, which is often responsive to requests for consultations or instruction sessions. Several of our participants mentioned becoming more proactive through scheduling workshops or trying to actively support credit courses. One participant noted that they felt the need to be proactive in their informal teaching because they weren't teaching a full credit course. Still others expressed discouragement at low attendance of workshops not associated with courses. One suggestion from the group was to focus our time on more sustainable long term efforts and plant the seeds of collaboration whenever the opportunity arises. In support of this approach, one geo-educator drew a direct connection between being more well known on campus, to an increase in requests and a second group noted the use of demo projects to show researchers that they have the skills to help them.

Geo-educators need to be:

- knowledgeable of many disciplines in order to understand what our users need,
- proficient in the use of maps, various data formats and a variety of GIS tools,
- nimble enough to balance professional expectations to publish/present with time to maintain and learn new skills
- able to effectively market their teaching services due to the informal nature of teaching in libraries

These skills need to be built over a career and require support from our institutions and one another. One key insight we gained is that due to the varied professional backgrounds of geo-educators, there isn't a unified community space or organization where people can share their work or discuss challenges they encounter as a profession. A shared community could help with boosting energy for maintaining proactive efforts and lead to a shared set of resources that would reduce our educational workload.

How do we work with various disciplines and support our communities?

As geo-educators, we encounter users from a wide range of disciplines, especially as more social science and humanities disciplines had their 'spatial turn'. Our users are from the digital humanities, biology, social sciences, history, art, urban planning, economics, and modern languages, in addition to, more traditional fields like environmental science, geology, civil engineering and of course, geography. Mapping and GIS are now popular visualization tools regardless of academic discipline. Given their general availability to lay audiences, we have an even larger charge as geo-educators to ensure that people are using these tools and associated data appropriately and ethically. Especially when working with disciplines other than geography, one goal is to help them understand how a spatial perspective can be useful for their discipline/area and translate that into the language of their discipline. This can include providing examples of existing projects in their area or how GIS tools have been used to analyze data from their discipline in the past.

The varied levels of knowledge our users begin with can also make teaching workshops particularly difficult, as we have to appeal to many disciplines (i.e., frames of reference) and levels of experience at once. This is compounded by the often quick, informal nature of one-shot lessons that are typical in library environments. One suggestion for appealing to students from multiple backgrounds in the same lecture is to come pre-prepared with a topic or case study with broad appeal. Not only can you engage student interests through this method, but you can also connect them to ongoing research happening at your institution. Other than workshop or classroom teaching, consultations are one of the key ways we support our communities.

Consultations

Consultations, or reference interactions, are open to students, faculty, community members and others depending on the type of library. In our conversations, geo-educators noted many different types of requests including help finding and purchasing maps and datasets, help using and manipulating existing datasets, and basic instruction on how to use a GIS software to analyse data. In some cases, researchers ask for bespoke development of a tool or on-demand map creation. Depending on resources and bandwidth, some libraries perform these types of bespoke services, others do not.

During consultations with researchers from other fields, one of our participants shared the observation that we have to balance between sharing general recommended practices for spatial analysis while also being sure to respect the constraints of the discipline of the users asking for support. During one conversation, someone suggested we share literature that might appeal to

students from these various disciplines, so that finding examples of applications of spatial analysis to a discipline specific problem is never too far out of reach.

Ironically, it seems that those least likely to seek support from geo-educators working in libraries are geography researchers, often as they have their own set of experts within their departments who offer targeted disciplinary guidance. One participant indicated that this could be because geography departments are often teaching ESRI and are (or at least think they are) self-sufficient. In other disciplines like architecture, training is focused on CAD and students and researchers do not want to learn to use GIS software as well.

For some participants the bulk of their consultations are about data acquisition: for others, it is mainly using GIS tools. Sometimes we need to provide multiple sessions to help someone, for example, users learning to use a particular method or analysis tool or for repeat users who need a lot of hand-holding. In either case, it seems that the nature of what consultations can be offered is bound by the skills of each geo-educator offering them. Therefore, the more skills we can learn, the more help we can provide. Consultation services could be extended at every library if we pulled together shared resources, methods for training, and worked together to further our own skills in a supportive community. One challenge with consultations is the limitations in service. Due to other commitments found in a geo-educators role, it can be hard to set aside enough time to meet requests for all consultations. This can be exacerbated by limited staff to help with these consults, and the extensive time cost for appointments that are more hand-holdy in nature. For a few participants who work in local government or provide data, they are often asked to create maps or help people collect data or use collector tools (Feb). At UNR, Chrissy provides peer tutoring services. In Michigan they sometimes get questions about NetCDF file format. Need: print maps and georeferencing, there is no central resource on this.

Several of our participants noted that there are differences in consultations requested by students, faculty, and community members. Students might need a more general introduction to GIS, support for social sciences and humanities coursework or projects, help with finding spatial data, selecting or learning a research method, or recurring consultations to build a workflow for their research. While faculty and doctoral students may also request data or a general introduction, they often have higher demands for services catered directly to their needs, such as more time intensive work related to analysis or bespoke generation of a map on-demand. These services are sometimes beyond what we can offer, especially as a solo educator or small department. Community members, including those who work for other public institutions, often request support for creating maps, request for public data, or support collecting data in the field, including tools designed to collect that data such as ArcGIS collector, survey 123, or an operations dashboard. One major consideration for helping

community members is ensuring they have access to tools. This is one reason supporting open source tools and open data are important for a robust service.

Tools

While the number of tools that can conduct spatial analysis grow every year, there is a core group of tools and products which geo-educators have become accustomed to working with.

Libraries have benefited from a close relationship with ESRI, the producer of the most prominent GIS software, ArcGIS, due to an early project to get their software into libraries. Traditionally, this meant access to PC desktop-based software, such as ArcMap and ArcPro; however, in recent years ESRI has been moving their services online, and those coming to libraries are increasingly seeking web tools. Indeed, we had one participant who stated that most of the questions she receives are from people new to GIS who want to learn more about ArcGIS Online, often deciding it is the best tool for them. This may be because it is relatively a lower lift than learning to code in R or Python. This also fits with the increasing popularity of their StoryMaps tool. One of our participants noted that the ubiquity of Apple computers often leads to difficulty for those trying to use ESRI products. This could mean that exposure to ArcGIS comes primarily in lab-based settings, which could limit students' experience with ArcGIS to one course or one semester. Some departments are still using ArcMap but most are now promoting ArcPro so we have to be prepared to support both. There was a mixed responsibility for administering access to ESRI products among our participants. Many geo-educators in libraries are one of a handful of administrators for ESRI licenses across the university, a few are the sole administrators, and some are not responsible for this at all.

Some geo-educators also referenced a need to provide support for QGIS. One participant indicated that if her university goes online in the Fall, due to COVID 19, she will convert to teaching QGIS. In many cases, geo-educators mentioned a desire to more fully support teaching users about open source software like QGIS or R. A few participants actively use and promote open source alternatives where possible but still maintain their skills in ESRI products because many courses still teach with them. While there is a lot of interest in expanding these services, the practical support for open source tools is limited.

Outside of these more traditional GIS software packages, several participants use coding languages to conduct GIS analysis including ArcPy, Jupyter notebooks, and R Studio. Python and R are perhaps the two most prolific examples of coding languages used within university departments that geo-educators are called to support. One of our participants spoke at length about his experience offering support for Python and the benefit it had to his other work around GIS education. Indeed, some of this need may stem from the departments themselves, as faculty are beginning to teach courses on mapping in code. Many geo-educators preferred open source options as many students and faculty

use Apple computers, which prevent the use of software like ArcGIS. These methods also have the benefit of being free and open source, which allows for more specialization of processes. Students can remove some of the black box nature of other software packages, as well as, continue to access the tools after graduation.

Through our conversations we learned that there are many exciting opportunities for geo-educators working in libraries to reach out beyond the walls of their libraries and work directly with students and faculty in their departments, or even more broadly with the community at large. The group creating demo projects find that having these projects available for users to review leads to more trust in their skills and ultimately, more consultations. Additionally, we have to balance when to educate and when to collaborate and when to delegate to outside experts. But in all cases, it was clear that those in our discussions who met with the most success were those who made expectations clear and set boundaries up front.

How do we teach and how do we track our effectiveness in teaching?

As many libraries seek to promote GIS and geography support, geo-educators have had to develop teaching materials that fit the needs of a diverse body of students, faculty, and staff. Each institution has set up various approaches on how they support GIS pedagogy; however, the needs of our users are often similar. In this way, working together to build pedagogical understanding, or themes within teaching approaches, is a way to provide support for those looking to develop teaching at their libraries.

It became clear through our conversations with geo-educators that as we move more prominently into the geography or GIS education space, it is important to note that there are several types of settings for teaching these topics within these various public and private institutions. These include workshops, guest lectures within established courses, full credit bearing courses, one-on-one consultations, or even asynchronous materials that can be accessed (and updated) at any time. Often we speak to students from multiple disciplines, enabling us to be one of the key spaces on campus that fosters interdisciplinary learning around spatial concepts. This also provides us key opportunities to play with the style and format for education sessions, which might not be afforded within a department.

Workshops

Workshops, either occurring as one-offs or in a short series, provide an efficient way for geo-educators to instruct on these topics to a wide audience. Ranging typically from one to five hours, these workshops can cover either tool focused instruction or geographical knowledge building. Steps to creating a successful workshop include creating learning goals or outcomes for students, much like you would do for a traditional credit bearing course. Another successful technique applied by participants was to use a workshop to create a demo project or follow a case study relevant to a particular discipline.

It is also possible to share workshops materials more broadly, due to the limited time frame of one-shot events. Once created, the outline for these small modules can be added to a learning "Commons" (such as that in Canvas or LibWizard), and thus can be run multiple times without additional planning stress. These modules can be added into classes as a convenient guest lecture. As there are relatively few elements in the commons for canvas space that focus on spatial literacy or RDM, we feel that as a group it is worth investigating whether or not we could contribute materials like this in the future to be used by academic geo-educators across the country. This might need to be

paired with a survey of these learning platforms to determine what models fit best with teaching spatial literacy or GIS skills.

Those who had ties to a more active professional network were quick to suggest cross education opportunities, either by collaborating with departments or with software producers (such as ESRI's education arm). These take the form of one-off targeted workshops on tool training (ESRI) or can manifest as monthly meetings between computer enthusiasts who have an interest in learning as a part of a community of practice. A thematic workshop series approach can bring together both geo-educators and other scholars around a central theme, e.g., gerrymandering, and in one case, fostered collaborations between the library, the wider institution and the city.

Courses / Guest lecture

With the increasing excitement surrounding maps and their use in research, geo-educators are sought out with increasing frequency for guest lectures in existing courses. As one participant put it, people think "maps are cool" and they can be used to get people interested in our services. Even when faculty have invited geo-educators working in libraries to be a part of their course, there is often limited time for us made within the schedule. In some cases, it has been beneficial for us to then refocus on promoting workshops, asynchronous materials, or consultations to offset the limited time allocated in the classroom.

A major positive of this approach is that guest lectures allow us to reach students who might normally not come into the libraries. To our knowledge, only a handful of geo-educators regularly offer full credit bearing courses through the library or in conjunction with another department on campus. A few interesting examples include classes on sports geography and spatial storytelling. This limit may indeed be due to the libraries being a newcomer to the credit course bearing space at many institutions, and the time required to teach full courses.

Just as there are many ways in which geo-educators can format their instructions, the topics discussed also vary. Not only in terms of focusing on geography subtypes (such as cultural, economic, or political geography) but also specific application of map analysis or creation (using popular purpose built GIS software or other tools). These can be viewed as two separate categories of instruction. However, it is also clear that as individuals in these areas have wide ranging expertise, the ways in which we instruct these skills and the concepts we teach are unique to their institution.

Through our conversations, it became clear that most of the geo-educators tasked with teaching spatial literacy must support GIS learning. Primarily as GIS related to analysis of spatial data or map creation. In many cases, this is tied to a specific departmental need or disciplinary focus, such as GIS for architecture or mapping for the humanities.

One of our issues as an instructor then becomes, how can I teach technology in a way that does not discourage learners? We need to strive to make learning fun, and the tools less intimidating for audiences unfamiliar with computers or the intricacies of spatial data management. While, at the same time, ensuring that people do not rush through a plug and play method that results in the creation of bad or misleading maps or results. It is also important that the tools or methods we engage with are not so specialised that no one will want to apply it to their own work.

From our conversations, it is clear that there is a desire to teach more than just tool use to our students. This can include guest lecturing on topics more at home in a cultural geography department, including sports geography, language courses that support digital projects, urban planning and architecture, and community economic development. There are also courses that focus specifically on traditional geography questions, such as analysing aerial photographs, geology, and geomorphology, and identifying relevant data in physical or digital maps. There are also cases of courses that focus on the evolution of the map over time, which can be woven into the context of several of these qualitative and quantitative focused courses.

We heard specific reference to teaching spatial literacy skills (such as recognising and using spatial data) and the big picture concepts from geography that enable students to understand the underpinnings of a map. This includes a deep discussion of who creates maps and map biases. Additionally, some participants were eager to incorporate topics like ethics, spatial empowerment, decolonization, addressing systemic racism and data contexts into their teaching. A strong desire from participants was to ensure we are preparing our students to analyze and make maps, but to be informed and empowered members of their communities. Even with these shared goals it is clear that the community needs to discuss what we consider to be core spatial learning principles. In future conversation, we hope to spend more time learning about more ways to incorporate these critical practices into our teaching.

However, the diverse range of settings and topics can lead to difficulty in teaching due to the level of expertise found amongst our users. In many cases, groups that can attend general workshops or courses outside of a geography department have had different exposure to spatial literacy concepts. This problem is perhaps compounded by the trend of high schools and universities to limit focus on geography, in comparison to our European counterparts. In some cases, students may not have been invited to critically engage with a map before or have limited knowledge of basic geography concepts. We must also consider how the concepts we employ will be understood by students from different departments. First and foremost, our goal must be to provide our students with a safe learning environment, which includes making room in pedagogical materials to carefully introduce students to important but often charged topics in ways that are beneficial to their learning as a whole.

It is hard to know where to begin in a tutorial if we do not know if our students need the basics of map building or tool training, or assuming they possess prior knowledge of map logistics and coding. In some cases, where libraries have a system in place for pre- and post workshop or instruction surveys, it may be possible to learn in advance who the audience will be and what information is best to include. When asked to provide a guest lecture in a course, it is also up to the geo-educator to work closely with the main course instructor to determine at what level of expertise the material should be designed.

In a post COVID-19 world, it is also vital for us to consider how our efforts will move virtually, both for how we teach tool training (which often benefits from extensive hands on instruction) and explaining our ideas on research projects developed by others on Zoom (which can take longer than in person meetings). Here, however, it is possible that geo-educators with computer skills (like those required to use GIS) may have an advantage. Even before the events of this summer, geo-educators working in libraries have been key providers of asychonist supportive material, such as Libguides or extended online tutorials. We are also benefited by companies and individual instructors who publish materials on line to aid in student learning, either towards a particular course project or to encourage the use of a product. Moving forward, having an online repository of our shared teaching materials and allowing educators to quickly adapt pedagogy around GIS and geography for specific cases, including asychonist models, will enable libraries to more quickly adapt to a virtual world.

Tracking effectiveness

To date, many geo-educators working in libraries have to this point focused more on gathering metrics on who makes use of their services. In part, this is to help them prove the 'success' of these efforts to library administrations. These statistics can also be used to track our impact among students and faculty. Eventually, this data may be used as a part of faculty promotion or to support the need to hire additional staff. As reported by a participant, we see the highest numbers at our workshop or one off training events, with about a ten percent return on investment to follow up consultations, and in comparison a one percent relationship to the number of individuals who enter into a collaborative pipeline. Even still, this data is difficult to track as geo-educators are often teaching in liminal education scapes. We are better prepared to track quantitative results rather than qualitative.

These qualitative aspects may relate to tracking engagement with our services over time, or how often someone needs to attend a workshop or consultation session before their skills improve or comprehend a core geographic concept. Unlike faculty who work with students over the several week time period of a course, geo-educators only have a short period in which to determine if their learning objectives were achieved. Post- education surveys may help with this, but there is no guarantee of workshop attendees completing them or of instructors for whom we guest lecture asking their

students to fill them out for our use. There is also the need to develop effective forms in which to gauge the success of these events. In this way, we as a community need to work on better reporting methods and definitions of learning outcomes.

Tracking engagement was also mentioned outside of the context of direct teaching opportunities. Indeed, outside of tracking workshop attendance or consultations, there are still many other methods for students to engage with geography or GIS within a library. This includes making use of our spatial data resources or physical maps from our collections. There are also cases where we might not be directly interfacing with students, but need to track support offered by our student workers or other members of library staff. In these cases, many still resort to counts recorded on paper or through a virtual tally system of who is using our spaces or data. In other cases, creating google forms can help us to track not only how many people are making use of our services, but also who they are. This can include their disciplinary focus or general background knowledge.

How do we manage our time and develop new skills?

One of the key issues identified by participants is the time available to them to focus on teaching and generating teaching materials. For many geo-educators, teaching is only one component of their work. Thus, workloads become a barrier to both effective teaching and learning new skills. Preparing for teaching requires a large time investment in general but the lack of a central repository of shared teaching materials leads to multiple geo-educators spending time creating content for the same tools and concepts. The natural evolution of GIS and other digital tools provides an added hurdle in that materials have to be routinely updated, as do the case studies referenced within them, to match current standard and capabilities of GIS software. Lastly, if you are teaching about a new tool, there is an initial time investment of learning how to use the tool, which is needed to effectively teach others. Luckily, these tasks can be coordinated and planned.

In other cases, faculty or community members reach out to us looking for help with a specific tool, dataset, or process. These requests are driven on-demand and may be for tools or processes that geo-educators are unfamiliar with and must spend time learning the basics of that tool in order to provide support. This means learning quickly and being proficient at using help pages. The demand for training and consultation is high and the key seems to be making our users aware of what our knowledge base is and getting them started while trying to connect them with an expert outside of the libraries. Several participants mentioned that they learn from graduate students and others during their consults: new skills are a by-product!

Many library leaders do not appreciate the time and resource commitment required to truly become proficient at using some GIS tools and methods. Better educating these leaders on what we need to thrive in our work will be needed to manage expectations and reserve time for learning. Few geo-educators begin work with advanced knowledge of multiple tools, methods and data sources. Many of these skills must be learned on the job and then maintained overtime. Maintaining up-to-date knowledge, especially for tools is a big issue, especially as people get more established in their role due to commitments and farther from their graduate training (and 'free' time to learn).

A few participants mentioned attending or holding monthly meetings for interested GIS users across campus. In one case, members of the campus planning department often came and wanted to learn Github. This could be a space to learn from other campus experts and occurs on a regular basis. Another participant tried to get a library focused Python group together, similar to a book club, but it didn't materialize because it was a busy time of year so people couldn't make it to all the meetings. At one library, a group meet regularly during the summers and teach each other tools and skills. This is a nice example of a time-bounded training group.

Others used individual training to learn new skills. Some geo-educators took credit courses early on in their career, while others learned GIS in their graduate programs. Some have taken focused courses to fill in specific knowledge gaps, one example was a Web GIS course. One participant took classes from the department they support in their work and this was a great way to make contacts with future users and other experts.

Online materials like tutorials on Linked In Learning, or looking up how-tos for specific tasks were used by many to stay up to date on new tools. A common practice is to attend one day conferences or regular full conferences including the Western Association of Maps Libraries (WAML) Annual Meeting, the North American Cartographic Information Society (NACIS) meeting, the University Consortium for Geographic Information Systems (UCGIS) Symposium, IASSIST conference, and Geo4LibCamp.

There was general agreement that we need better library oriented training resources. One challenge people faced is to remember what you learned when you need it. To combat this for programming tasks, one participant regularly uses python to do other tasks in his work so he stays current and practiced. Another participant blocks chunks of time on his calendar to learn new tools and skills. Some other time-based needs mentioned in the conversations include the option for a sabbatical for those in faculty roles or dedicated down time for staff, allocated time for grant supported work, communities of active researchers in geo-education and libraries, training on grant writing and fundraising, a collaborative annotated bibliography and parking lot for potential collaborative projects, and developing collaborative services to take more burden off of individual geo-educators.

Conclusions and next steps

Objectives and Takeaways

At the start of this project we had three main objectives. (1) Research network of interested people; (2) Repository of reusable pedagogical materials; (3) Understanding of the landscape of informal education happening in libraries and other informal learning spaces. These areas provided a base for us to ask about the status of geo-education in libraries, and what librarians are doing to further the field. Moving through a discussion of these goals, there are many connections with the four high level takeaways outlined in the 'What We Learned' section of the report.

1) Research network of interested people.

At the outset of this project, we had intended to develop a network of professionals specifically focused on education that could help connect us, and others, to resources related to GIS and Geography pedagogy. We wanted to create a list of professionals for others to learn from, particularly as we had struggled with finding resources while building our GIS Libraries program at CMU. However, while connecting with geo-educators we quickly learned that there was a need for spaces where librarians could discuss the issues at large within the field. These include topics from the basics of what a geo-educators must offer for their patrons to what are the core-concepts we need to push in curriculum.

This particular goal aligned clearly with all four of the high-level takeaways, as through building these connections we began to uncover various aspects of the role of geo-educators within their unique institutions, the focus of instructional efforts made by them, and how these individuals are dealing with the growth in popularity of their services.

Thus, ROLGGE fostered more than a simple network, but a true community of geo-educators determined to push what is possible for GIS and Geography education in informal learning spaces. This community was able to address our second and third goals.

(2) Repository of reusable pedagogical materials.

At the outset, our goal was also to gather existing spatial literacy pedagogical materials that can be offered alongside more traditional tool training workshops and consultation services libraries have traditionally focused on. Through the course of our discussions, we asked for participants to share materials they constructed as guides for others.

Towards the end of the program, it became clear that geo-educators need access not only to repositories of spatial data, but to instructions guides as well. Geospatial pedagogical materials for informal learning spaces, used to train our patrons or ourselves, are currently difficult to find, leading to the need for an accessible repository or bibliography. Working with participant Belle Lipton, we explored what methods might be most effective to share pedagogical materials and spatial data.

Further evaluation of how geo-educators can meet the rising need of our constituents, clambering for exponential access to learning resources around a myriad of GIS data and software needs to be conducted. As highlighted in high-level takeaways, it is not only what teaching materials we can share, but knowledge of who those materials are targeting.

Examples of tutorials created by participants that were shared during the conversations can be found later in this document in the section on **Shared Materials**. There is a live version of this listing on Github, and we encourage anyone with relevant teaching materials to share and those in need of teaching materials to explore.

(3) Understanding of the landscape of informal education happening in libraries and other informal learning spaces.

Our final goal was the most ambitious. It became clear that due to the geo-educators community being segmented across geographic areas and institution types, it would be difficult for us to provide a holistic understanding of what is happening in libraries at large. In part, our desire to focus on conversations as a way to understand our community resulted from the lack of written material on pedagogical goals beyond GIS tool instruction. What we have shared in this report is a glimpse of the flurry of geography and GIS education activity happening in some libraries in the US. There is still so much more we can learn. By broadening our scope of conversations (locally, regionally, and nationally) and our methods for fact finding, we can further build our knowledge of what it means to be a geo-educator in informal instruction spaces.

Through the course of ROLGGE we learned these three core areas were not enough to encapsulate what participants brought up in discussion or what is needed by geo-educators across North America. We need more than just a network of interested people. We need a community of practice, or a body of librarians who will regularly meet to build on their concern or a passion for Geography and GIS education within informal teaching environments. This goes beyond connection to sustained collaboration.

What's Next?

The question is now not only where do we go from here, but how can we get others involved?

As the organizers of the Role of Libraries in Geography and GIS Education project, we feel it is essential to maintain momentum in this area going forward. We can begin by reaching out to University Libraries on a national level to determine the broad state of the field for GIS and geography education in academic libraries. This could be done through additional conversations and collaborative professional development opportunities, as well as, surveys sent to geo-educators.

This would build off a survey conducted at the end of the project to ask participants what goals we should explore to maintain and build on the success found in ROLGGE. We plan on offering a survey to the broader geo-educator community that will gather information on how to build a community of practice for geo-educators at multiple types of institutions. This survey would explore the development and continuance of a group of dedicated practitioners, while defining how to share materials developed by individuals within that group for use by geo-educators around North America.

During our wrap up conversation, the community suggested that we continue to meet monthly or quarterly. The next stages of ROLGGE will thus include monthly virtual meetings to ensure the active continuation and growth of the group. In our initial sessions we focused on predetermined topics from the ROLGGE team. Moving forward we will encourage other members of the group to suggest topics for discussion, present on their work, and seek feedback, discuss what is needed. These conversations will occur on a Thursday each month.

Future conversations will likely occur on a groups.io page or dedicated Slack channel, as well as, possibly storing our shared teaching materials in Github or within Open Science Framework. This ties with the desire from many geo-educators to have access to a listserv that would keep those connected periodically to the discussions happening in the community. A groups.io page or Slack workspace would allow for ongoing convenience of allowing people to connect on different topics at their leisure, while also broadcasting summary reports of updates discussed within. This would also help to target areas of key development still needed within the field, ideally helping people just connect and build new collaborative projects.

We hope to gather a group of participants to put forward a new grant proposal that will fund future efforts. Many of our participants indicated a strong interest in collaboratively working on proposals to fund the future of this community. Funds might go to support maintaining the services that support our virtual and in person interactions, as well as, provide backing for additional projects such as a stable repository of materials, journal articles or whitepapers, and the possibility of supporting MLIS students who seek to enter the field with GIS and Geography librarianship competencies. As

suggested by one of our attendees, having goals that exceed conversation alone will help us sustain the community through the active engagement of participants in projects that revitalize the community of practice around this area.

Anyone who wishes to join ROLGGE is encouraged to do so! To get connected, go to: https://groups.io/ and search for Geolibraries or contact GISlib@andrew.cmu.edu.

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Participants

Below is a list of all participants who attended a conversation with us this year. **Thank you to everyone who joined us!**

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Shared Materials

This is a version of a shared listing teaching materials related to GIS, geography and spatial literacy as of this date. The document continues to grow. If you would like to add a link or find a link to teaching materials or websites focused on GIS and geography in Libraries or other non-traditional teaching spaces, please add them to this Github space https://github.com/bellegis/geolibraries. If that link doesn't work, check out www.library.cmu.edu/gis.

Datasets

MIT GeoWeb, https://geodata.mit.edu/, MIT Featured Data Collections.

GIS Vector Data, https://geospatial.com/products/gis-vector-data/, GIS Vector data from East View Geospatial, focusing on plug and play data sets for novice and expert GIS professionals.

Lesson Plans

GIScience / GIS / Geospatial Instructional Resources, https://www.ucgis.org/gis-instructional-resources, This collection emphasizes Open Educational Resources for the teaching and learning - about and with - GIScience, GIS, and related geospatial and mapping technologies.

Teach GIS, https://teachgis.org/, TeachGIS.org is a reference website offered by the University Consortium for Geographic Information Science. A referatory, it is designed to point you to useful tutorials, data sources, and publications relevant to the teaching of geographic information science (GIScience) in higher education. It is a beta project seeking feedback and contributions from the community of GIScience educators.

Presentations

GeoDa Software, https://spatial.uchicago.edu/online-lectures, LUC ANSELIN'S RECORDED LECTURES ON YOUTUBE

Tutorials

GIScience / GIS / Geospatial Instructional Resources, https://www.ucgis.org/gis-instructional-resources, This collection emphasizes Open Educational Resources for the teaching and learning - about and with - GIScience, GIS, and related geospatial and mapping technologies.

Teach GIS, https://teachgis.org/, TeachGIS.org is a reference website offered by the University Consortium for Geographic Information Science. A referatory, it is designed to point you to useful tutorials, data sources, and publications relevant to the teaching of geographic information science (GIScience) in higher education. It is a beta project seeking feedback and contributions from the community of GIScience educators.

Story Map Tutorial, https://storymaps.arcgis.com/stories/4116d0fb72e6446aa8652ea605e9fc7f, A tutorial on how to construct story maps, and the special features within, itself made and run in story maps. Content is in part based on ESRI website guides, Emma Slayton / eslayton@andrew.cmu.edu

Mapping for the Urban Humanities, https://github.com/CenterForSpatialResearch/mapping_for_the_urban_humanities, Tutorials and Resources for Summer 2019 Mapping for the Urban Humanities Faculty Bootcamp at the Center for Spatial Research. Instructors: Bernadette Baird-Zars, Eric Glass, Leah Meisterlin.

Aerial Photographs Tutorial, https://mines.libwizard.com/f/airphotos, This tutorial will teach you a basic understanding of how to use and interpret historical aerial photographs (air photos), Christopher Thiry.

Geospatial Workshop, https://datacarpentry.org/geospatial-workshop/, Data Carpentries lesson on geospatial data concepts, an introduction to R for learners working with geospatial data, and how to open, work with, and plot vector and raster-format spatial data in R.

Leaflet Tutorial, https://joshuafrazier.info/leaflet-basics/, In this tutorial, we will use basic HTML, CSS, and JavaScript (specifically, the Leaflet JavaScript library) to create a series of progressively complex web maps.

Map Box Tutorials, https://docs.mapbox.com/help/tutorials/, Find step-by-step guides to help you get started with Map Box or take your project to the next level.

Something About Maps, https://somethingaboutmaps.wordpress.com/tutorials/, The cartographic community thrives on a culture of sharing knowledge, and I am happy to play a small part in that culture by offering some practical advice from my mapmaking experience. Daniel Huffman.

Cartinal The Leventhal Map & Education Center's guides & documentation pages. Geared towards public audiences, with tutorials and guides focused on open software environments. Also includes documentation for the Map Center's GIS & DH projects.

LibGuides

Geographic Information Systems (GIS): Tutorials and Help Resources, https://libguides.mit.edu/gis/tutorials, Collection of tutorials from the MIT Libraries, including finding data, working with census data, mapprojection, geocoding, and much more!

Maps & Geospatial: Case Study Applications Across Disciplines, https://guides.libraries.psu.edu/c.php?g=609226&p=4228719, This guide from Penn State provides resources, examples, and references arranged by college and discipline as starting points for users to explore how geospatial information is used in their respective fields.

Map Club at Columbia, https://library.columbia.edu/services/research-data-services/map-club.html, provided by Research Data Services, is for those who want to learn more about mapping, spatial data and GIS. Open to beginners and experts, the club is a space to experiment with web-based libraries or frameworks and GIS tools.

Cartinal The Leventhal Map & Education Center's guides & documentation pages. Geared towards public audiences, with tutorials and guides focused on open software environments. Also includes documentation for the Map Center's GIS & DH projects.

Full courses

We Mapped This City: Centering Health Resources and Engagement Around Community Assets, https://nnlm.gov/we-mapped-this-city, Covers the basics and potential applications of community asset mapping.

Mapping for the Urban Humanities: A Summer Institute, https://c4sr.columbia.edu/news/apply-mapping-urban-humanities-summer-institute, Mapping for the Urban Humanities is a six day skills-building workshop in critical cartography, designed to expand the disciplinary locations within which spatial knowledge in the urban humanities is produced and interpreted. Workshop participants will be introduced to open-source mapping software, QGIS, to methods of data collection and creation, and to approaches and concepts in critical spatial analysis that they can incorporate into their research and teaching.

QGIS Practicum Course, https://www.baruch.cuny.edu/confluence/display/geoportal/, This introductory manual for learning GIS with QGIS is used in the day-long workshop held at Baruch each semester, which is open to Baruch and CUNY affiliates. For more information and registration visit the practicum page on the GIS Research Guide. Anyone and everyone is welcome to use this tutorial for

personal or classroom use under a Creative Commons BY-NC-ND license. However, you may not copy and re-host this material on another website.

Summer Program in Quantitative Methods of Social Research, https://www.icpsr.umich.edu/icpsrweb/content/sumprog/courses.html, from ICPSR. the Inter-university Consortium for Political and Social Research (ICPSR) has offered the ICPSR Summer Program in Quantitative Methods of Social Research as a complement to its data services.

Geo4Lib Camp, https://geo4libcamp.org/2020/, Geo4Lib Camp is run by Stanford University, and through this link you can access information about the event held in 2020, which is a baseline for other offerings of this kind.

Class Exercises

Looking at maps, https://docs.google.com/document/d/1q68wU5s8l6Mx9B1azcnuYUmoiai6KfSYqRka1XrlVsE/edit?usp=sharing, Cowart 2018 class exercise for Geography 183, shared by Susan Poweel.

Map Exercise, https://docs.google.com/document/d/1d8SMWPjZffiK0-OGwQE8FuFSUEU5Fxu06vI02A_S-So/edit?usp=sharing, Honig 2019 Spring, shared by Susan Powell

Extensive curricular activities for interrogating cartographic resources on a number of topics from the Leventhal Map & Education Center: https://www.leventhalmap.org/education/

Projects

DONALD W. HAMER CENTER FOR MAPS AND GEOSPATIAL INFORMATION: Projects to increase the discoverability and accessibility of collections, https://sites.psu.edu/mapsgislib/projects/ , Projects to increase the discoverability and accessibility of collections

Useful articles

Degree outcomes and national calibration: Debating academic standards in UK Geography, https://ouci.dntb.gov.ua/en/works/9QgQagN4/

Understanding spatial literacy: cognitive and curriculum perspectives, https://www.tandfonline.com/doi/full/10.11120/plan.2006.00170026, List of Community Members, Helen King / Helen.King@plymouth.ac.uk

New Information Literacy Instruction,
https://books.google.com/books?id=jQquCgAAQBAJ&dq=sinton+%22spatial+literacy%22&lr=&source=gbs_navlinks_s, View chapter 10, Patrick Ragains and M. Sandra Wood

Map, GIS and Cataloging / Metadata Librarian Core Competencies,
http://www.ala.org/rt/sites/ala.org.rt/files/content/publicationsab/MAGERTCoreComp2008.pdf, Documentation outlining core competencies in the map librarianship profession that previously did not exist. These Core Competencies outline and articulate the special skills needed to provide high-quality professional support to users of cartographic and geospatial materials.

Core Competencies for Map, GIS and Cartographic Cataloging/Metadata Librarians,
https://alair.ala.org/bitstream/handle/11213/10961/MAGIRT%20CoreComp_2018_ALAconnect.pdf?sequence=1&isAllowed=y, The charge of the MAGIRT Core Competencies Task Force is to create core competency standards for the map and Geographic information systems (GIS) professions. The resulting document identifies the fundamental knowledge, behaviors, and skills currently essential to most professional positions within the map/GIS information field. It is intended to be a flexible document that can be revised as the field evolves and changes.

This work was conducted by two geo-educators at Carnegie Mellon University Libraries.