

Final Report: *Enhancing Student Engagement and Skills through 1-credit 'Visualization Labs'*

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I. Review of Original Goals and Objectives

Goals: to teach and share digital visualization techniques for the purposes of more deeply engaged learning experiences, engage in 21st-century skill-building for students and faculty, improve communication of course-based research, and enhance the visibility of innovative pedagogical approaches at UVM.

Objectives: 1) Expand the capacity and expertise of students and faculty in diverse forms of data visualization and analysis. 2) Foster interdisciplinary communication, knowledge-construction, and innovative pedagogies. 3) Build a community of faculty and students who have basic digital visualization skills so that such technologies are demystified and put to good use in scholarship and learning.

II. Description of accomplishments and outcomes

Overview: This project's goals demanded a wide-ranging and collaborative approach involving multiple faculty members and their departments/colleges; professional staff from CTL, the Media Lab, and the Libraries; and technical support from diverse sources around campus. It is telling that the project ended up under-budget precisely because there was so much enthusiasm and interest in the mechanics and ultimate success of the endeavor that individual staff and faculty poured enormous energy and commitment into making it happen. This passion and commitment demonstrates that future expansions of digital scholarship, innovative data visualization pedagogies, and skill-building for students and faculty at UVM are eagerly desired – the administration would do well to foster such expansion through targeted investments and heightened attention.

What was done?

The main strategies of action were: A) to provide campus-wide faculty workshops on digital visualization technologies and B) to enable six faculty from Social Sciences and Humanities disciplines to add 1-credit visualization labs to existing 3-credit courses as a pilot test. The details of these are shared below, with critical review appearing in the following section.

A. Workshops for Faculty, Staff, and Graduate Students (see Appendix 1 for schedule and details)

To boost the capacity, awareness, and use of existing digital and visualization tools on campus, we partnered with the Media Lab, the Center for Teaching and Learning, the Spatial Analysis Lab, library

faculty, and statistical support personnel to offer six workshops (4 in spring, 2 in fall of 2017). Every one of these was fully enrolled with approx. 20 participants:

- Visualizing Time: Using Timelines in Digital Representations (February)
- Visualizing, Analyzing, and Presenting Tabular Data (March)
- Mapping Stories: Enriching Maps and Creating Spatial Narratives (April)
- Video Techniques for Digital Scholarship (May)
- Adobe Illustrator for Research and Teaching -- 2-part series (November)

CAS faculty were prioritized for enrollment thanks to an agreement with the Humanities Center. Participants included the following disciplines (all workshops combined):

Anthropology	Leadership & Dev't/CESS
Art & Art History	Linguistics
Asian Languages & Literature	Philosophy
Biology	Plant & Soil Science
CDAE	Political Science
Chemistry	Religion
Economics	Romance Languages & Literature
Film & Television Studies	RSENR
Geography	Sociology
Geology	Student & Community Relations
Historic Preservation	Transportation Research Center
History	

B. Pilot Project adding 1-credit visualization labs to existing social sciences and humanities classes.

Fall 2017:

Prof. **Meghan Cope (GEOG)** taught GEOG170/HST170 “Historical Geography: Mapping American Childhoods” with Daisy Benson (Library Faculty) teaching the 1-credit GEOG195/HST195. Students learned to access historical materials and to visualize their independent project data and analysis using Social Explorer (US Census data mapping), Hathi Trust, Ancestry.com, WordPress, TimelineJS, StoryMapJS, and Excel. Drafts of the final projects in the form of posters were shared in an interactive exhibit in Nov. 2017 in which 40 students from a “Sociology of Childhood” (SOC128) class, as well as other guests, attended and gave feedback to the Historical Geography students through comment cards, in-person questions, and discussion of results. Final projects were websites, which can be seen here: <http://blog.uvm.edu/mcope-childhoods/american-childhoods-1850-1950/>.

Prof. **Caroline Beer (POLS)** taught POLS095A & POLS095Lab01, “ISSP: Global Gender Inequality”; Prof. Beer covered the 1-credit visualization lab herself, using the functionality of Excel. Students chose different indicators from the World Bank’s Databank to measure gender inequality across countries. They mapped these data and also used Excel to display them in different types of graphs. Then they developed hypotheses to explain why gender equality varies across countries and collected data to test their hypotheses. Each final paper included correlation coefficients between their dependent and independent variables and scatterplots to visually display the relationships.

Prof. **Melanie Gustafson (HST)** taught HST295C/HST395B, “Visualizing America” with support from Hope Greenberg (CTL). The laboratory component of the class allowed students to critically evaluate digital

projects while learning and practicing digital skills (ThingLink, word-clouds, PDF annotations, WordPress, TimelineJS) that were structured around a set of readings and assignments about histories of the built environment. The capstone group project, chosen by the students, was the building of an *Omeka* exhibit investigating the culture and politics of Burlington's Memorial Auditorium in the 1980s. It included digitizing and providing metadata for primary source documents, then writing a framing narrative. <http://ctl.w3.uvm.edu/omeka/exhibits/show/2017-visualizing-america>

Spring 2018:

Prof. **Cherie Morse (GEOG)** taught GEOG061, "Geography of Vermont" with support from an undergraduate TA paid by the EPI grant and trained in *Adobe Illustrator* by the Media Lab. The visualization lab taught students *Illustrator* in projects constructing 'broadsheets' to demonstrate Vermont themes. Prof. Morse found the visualization lab to be an effective 'equalizer' in the course, whose students ranged from first-years to graduating seniors with a range of experiences with Vermont and the discipline of Geography.

Prof. **Vicki Brennan (REL)** taught REL196B, "Religion, Sound, and Space", in collaboration with the Media Lab, using WordPress, Google Maps, *Audacity* and several other digital tools. Additional support was provided with EPI funding to pay Andy Kolovos (Vermont Folklife Center) for two workshops on how to conduct interviews and create archival-quality recordings. Students learned basic ethnographic methods and mapping techniques, and then how to create and edit soundscape recordings using *Audacity* and generated short documentary videos; they also learned to analyze and present their findings in a variety of digital media formats. Final projects here: <http://blog.uvm.edu/vlbrenna-burlingtonsoundscape/>

Prof. **Ingrid Nelson (GEOG)** taught GEOG 273/ENVS 295 J: "Advanced Topics in Political Economy and Ecology: Making Southern Africa", and taught the lab herself. Using digital mapping, material production, and critical visualizations, students explored multiple dimensions of real and imagined spaces of Southern Africa through multi-media approaches. The students initiated and executed an exhibit at the *Student Research Conference* in April 2018 that showcased the five group projects based on themes: popular economies, controlling water, fashion, processing gendered traumas, and perceptions of Southern Africa.

III. Assessment of Impacts

Assessment was embedded in this project all along through both informal and formal mechanisms. Informally, the group of instructional faculty and supporting research/staff members met at least twice a semester, with additional communications by email, to organize, reflect, share ideas, plan, and occasionally gripe about how best to execute first the workshops and then the six classes with viz labs. More formally, we were able to assess various elements of the project in several ways, outlined below, along with specific recommendations for the future.

A. Workshops – the first feedback regarding the workshops was the rapid and enthusiastic willingness of experts across campus, from the Media Lab, CTL, the Libraries, and the Spatial Analysis Lab, to provide these experiences for faculty. The second positive response was by faculty across campus in participating in learning to use digital visualization tools: every workshop filled almost immediately, we received many emails of excitement and eagerness, and we maintained waitlists for those who didn't get a spot. After the first few workshops we prioritized College of Arts and Sciences faculty by sending the announcement to them a few days before opening it more broadly so that we could meet a request by the Humanities Center (which provided supplemental funding) to target CAS faculty. We did not conduct workshop assessment systematically but the verbal feedback was overwhelmingly enthusiastic

and participants' unwillingness to leave at the end (at 5:30pm) strongly indicated their hunger for this knowledge and expertise.

B. Classes with visualization labs – The six courses were assessed in two ways: a separate student evaluation for the visualization labs was developed, customized by instructors, and carried out in five of the six classes (GEOG061, GEOG/HST170, GEOG273/ENVS295, and ISSP-POLS095). This evaluation constituted an indirect assessment of student learning. Second, the teaching faculty and support staff held a wrap-up reflection day lunch, reviewed student work in classes with web-based final projects (direct assessment), and evaluated the challenges, successes, and goal alignment of their courses.

1. Student Evaluations (Indirect assessment - Samples are included in Appendix 2).

Overall positives noted by students include:

- Development of research, analysis, and visualization skills
- Thinking visually (and critically)
- Bridging the gap between concrete and abstract
- Creating compelling narratives
- Exposure to new ways of engaging with information, stories, numerical data, etc.
- Doing real-world work in analysis
- Utility of skills in other classes and in future employment
- Integrating diverse data sources and media
- Completing a digital project that can be widely shared
- Hands-on, experiential learning
- Chance to explore and build creative expression in fields typically dominated by paper-writing

Overall negatives or gaps noted by students:

- Sometimes difficult to balance mastering the content of the course with the technical demands of the lab
- Some instructors were not adequately experienced in the tools they were teaching
- Frequent mention of other tools students *wished* were taught: Mapping/GIS, Adobe Illustrator, making podcasts and blogs, statistical analysis
- Technical support inadequate for some students using some tools

2. Faculty/support staff assessment, reflection, and critique exercise

Overall positives noted by participating faculty and support staff:

- Students were excited to find, analyze, and visualize data in support of their research projects
- Students gained practical and professional skills
- Lab-based work fostered a sense of common goals and supportive community among students
- Web-based final projects generated strong communication skills – direct assessment of these showed approximately 75-90% of students were able to use visualization techniques successfully to represent quantitative data, analyze relationships, construct a strong narrative for their project, pull together different techniques to create engaging materials, and reflect on their processes of skill acquisition and demonstration positively.
- Students were empowered with understanding how to find data, how to use technical skills to build a visual representation, and how to share those findings in diverse ways

- Students reported that visualizing information themselves raised their critical own information/media literacy
- Public presentations (gallery walks, exhibits, websites, and the Student Research Conference) “upped the game” for students and resulted in more sophisticated and polished work
- The experience of these courses built connections between faculty and students, and between both of those groups with the instructional staff and resources around campus
- Faculty themselves learned a lot, both in terms of technical skills and pedagogy
- The visualization labs allowed sufficient time for students to really learn to use the skills, equipment, and resources needed
- The courses involving group work reported that strong ties were built in dealing with technological learning simultaneous to critical thinking

Overall challenges noted by participating faculty and support staff:

- Registration challenges – some students put off by additional workload of extra 1-credit and thus lower than expected enrollment in several courses
- Scheduling challenges – many courses required special room configurations (e.g. not just tablet-chairs) or classroom technology that was difficult to access; scheduling labs was also difficult and the common solution of teaching them at 8:30am was not popular among students
- Pedagogical challenge of how / how much to integrate lab into class content and vice versa
- In some cases, getting IRB approval in time for the course research was difficult
- Students come in with a wide range of both technical and content backgrounds
- Need for technical and teaching assistance to manage additional lab workload
- Even with a lab instructor there was a higher-than-expected workload for primary faculty
- Spring workshops were helpful introductions to visualization tools but not sufficient to then allow faculty to actually teach students to use them; faculty need more experience themselves with tools to be able to make the most effective use of them in teaching
- Excitement about digital tools sometimes took over, making the need to slow down for deeper learning suddenly obvious
- Lack of a central unit or portal on campus that coordinates access and support for diverse digital tools (from Excel to Adobe Illustrator to GIS) created inefficiencies and frustration
- Everyone (students and faculty) wants to know how to use Adobe Illustrator but the only campus facilities are in the Media Lab (Howe Library) and Waterman – need a broader site license and routine workshops in this technology

‘Big picture’ feedback by participating faculty and support staff:

- The experience brought visibility to existing digital scholarship and pedagogical innovations
- The project made digital tools more accessible and less ‘scary’
- A ‘community of practice’ was begun (and needs to continue!)
- The workshops taught faculty of all levels, ages, disciplinary backgrounds, etc. new technologies
- Sharing the students’ work publically is essential and very gratifying to all
- Need to support and expand a robust ‘digital humanities’ thread at UVM
- The students were deeply engaged in the work, well beyond a ‘typical’ class
- Students and faculty learned, critiqued, and refined 21st century skills of visualization

- Financial return on the extra 1 student credit hour (through IBB) enabled funding instructional staff, course equivalencies, and TAs → could be used even more creatively in the future
- The project sparked a great deal of cross-campus communication and better knowledge about what is already available, who the experts are, who's doing what kind of innovative work, etc.
- Instructional faculty involved have already built on their experiences and expanded them successfully – achievements include recognition for innovative pedagogy in RPT process, summer funding for additional research, continued use of a visualization lab for POLS095 with CAS-funded TA in Fall 2018, professional development for library staff, successful grant application for digital humanities project started in the visualization lab, successful book contract on topic of the GEOG/HST170 course, and continued interest in building a “Digital Scholars’ Lab” at UVM.

Summary of assessment – There were distinct challenges associated with creating a new instructional model (1-credit visualization labs) that involved everything from technical issues to a lack of faculty expertise, from registration and classroom configurations to early morning labs, and from faculty workload to student interests. Overall, however, this model was successful in meeting and exceeding its goals of enriching and deepening student learning, both in content areas and in analytical and representational skills.

Goals:	Indicators of Success:
to teach and share digital visualization techniques for the purposes of more deeply engaged learning experiences	Expanded the capacity and expertise of students and faculty in diverse forms of data visualization and analysis; enabled and stimulated deeper student engagement in learning by incorporating enticing visualization tools and strategies
improve communication of course-based research	Published student work on widely accessible websites, which were in turn shared on social media; held gallery walks and exhibits of student work on campus for diverse audiences (other faculty, administrators, library faculty/staff, students in other courses, community partners, the general public); showcased student work in a coordinated exhibit at the Student Research Conference. These generated significant exchange of knowledge across disciplines and fostered extensive new connections across campus.
engage in 21 st -century skill-building for students and faculty	Students repeatedly reported appreciation for learning tools they view as essential to their academic success and their future internships, employment, and civic engagement; faculty enthusiastically welcomed the chance to learn digital visualization tools (or, in Prof. Brennan’s case, <i>aural</i> tools!), and invested tremendous time and energy into employing them in novel ways in teaching and scholarship. This experience helped build a community of faculty and students who have basic digital visualization skills so that such technologies are demystified and put to good use in scholarship and learning.
enhance the visibility of innovative pedagogical approaches at UVM	Innovative pedagogy is already happening in many exciting ways at UVM – this project gave those a boost in technical and financial resources and the results have been highlighted in several accomplishments of students and faculty.

IV. What's next?

All the participants, particularly the PI, are grateful for the financial support provided by the EPI grant and the Humanities Center, but it is notable that an essential catalyst was the interest and enthusiasm across all campus populations for increased familiarity and use of digital visualization tools. Universities across the country are committing resources to streamlining and supporting digital scholarship and teaching and the members of the UVM community are eager to join this movement. Toward this end, we have several recommendations:

1. Publicize the innovative teaching and scholarship that this project has stimulated through news pieces, university communications, and a permanent website that can serve as both a repository and outreach to new audiences, including prospective students, alumni, community partners, and others.
2. Centralize and streamline existing campus resources so that instruction, software, and technical support are more easily discoverable. The ideal host for such a central location (even a 'virtual' one) is through the libraries and/or the Humanities Center. The nascent 'Digital Scholars' Lab', which is a loose collaboration of faculty from several colleges and the libraries could assist in that endeavor.
3. Explore ways to regularize and institutionalize the visualization lab model that addresses some of the above challenges while maintaining the excitement and energy provided by participants.
4. Invest in campus-wide licenses and training for Adobe Illustrator (Creative Suite), which is powerful, flexible, and the industry standard in our increasingly visual media, communication, and daily lives. Identify ways that Illustrator can be employed in teaching and invest in those developments.
5. Implement a regular cycle of offering digital tool workshops to faculty, staff, *and* students through a central mechanism so that existing software and expertise on campus can be more widely known and shared. Current pedagogical training through CTL is primarily focused on the mechanics of course delivery, assignment-building, and information literacy and writing. However, faculty want and need access to professional development opportunities for data analysis and visualization technologies that not only boost innovative pedagogy, but also deliver our students the education and skills they require in this digital era.

Enclosures:

Appendix 1: List and description of workshops / Flyer

Appendix 2: Sample student evaluations from 5 out of 6 pilot classes

Appendix 3: Course flyers from REL196 and GEOG/HST170