Driving the Team: A Course Integrated Data Information Literacy and Science Communication Class

Megan Sapp Nelson

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INTRODUCTION

This paper highlights a course transformation that included disciplinary faculty and research laboratory members as collaborators. Their integration within a course that was designed to highlight data information literacy (DIL), information literacy (IL) and communications learning objectives created an engaging learning environment. In turn, students applied seemingly abstract or unrelated skills to their major in concrete activities that built skills and enhanced their resume.

Faculty members of Library Sciences and Earth, Atmospheric and Planetary Sciences developed this course. The topic of the class was "natural hazards and community resiliency." The students learned the atmospheric sciences of hurricanes and tornadoes, as well as the geosciences of earthquakes. They equally learned IL/DIL skills such as finding credible sources, reading a scholarly paper, finding and reusing data, citing scholarly work including data, and sharing data with others by using file naming and data dictionaries. Additional collaborations with professionals in specialized fields enhanced the realism of and lead to greater authenticity in IL/communications assignments.

REVIEW OF LITERATURE

Librarians have had a long-standing role facilitating scientific communication, whether educating communicators on facets of the written communication process, or providing services tailored to meet the needs of communicators at their local institutions (Garvey, 2014). Librarians have also participated in scientific communication courses where science students were taught written scientific communication (Liu & Houdek, 2006). Mounce found that librarians have collaborated across the sciences, primarily as curriculum developers but also as embedded librarians and instructors of record (Mounce, 2010). These deeper roles have emerged as an extension of the tailored service model, arising to address specific needs noted in particular situations (Pritchard, 2010).

The integration of DIL within science courses was among the earliest of the data literacy curricula developed (Primich, 2010; Qin & D'Ignazio, 2010). A course developed at Johns Hopkins targeted science graduate students with the intention of building data management skills in future science professionals. In the process, Qin & D'Ignazio proposed one of the first, if not the first, data literacy competencies lists within the LIS literature (Sapp Nelson, 2017).

CURRICULA OVERVIEW

This curriculum emerged during ACRL Immersion Teacher Track (http://www.ala.org/acrl/immersion/teachertrack) in 2012, starting with a limited attempt to re-write one assignment to integrate data re-use. The existing assignments at that time focused on practicing IL skills. The feedback from the students taking the course was largely negative. They were disengaged, skipped class frequently, and saw little applicability of the content to their disciplinary courses or career trajectory. Additionally, the author didn't enjoy teaching the course. The goal of the Immersion overhaul was to take a traditional lecture style curriculum and integrate active learning.

The curriculum overhaul started with the capstone project in the summer of 2012 to be taught in the Spring semester of 2013. Once the author rewrote one assignment, then the other assignments no longer were appealing or effective enough to keep in their original form. By November of 2012, all assignments in the course were redesigned by the author to focus around a fusion of the fundamentals of extreme weather and natural hazards, information retrieval and synthesis, data reuse and visualization, policy and decision-making and scientific communication.

The curriculum focused upon integrating active learning, IL and data management whenever possible. The challenge lay in making room for a number of guest lecturers who presented the technical content, including the basic science of severe storms, earthquakes, and hurricanes, public policy formation and the role of science in policy, and disaster response professionals detailing the process and standards of disaster response. While a guest lecture is typically viewed as a one-shot with little carry-over to the rest of the course, the author sought to tie in the content of the guest lectures to assignments and to the overarching narrative of the course, so that the curriculum had greater relevance.

Additionally, the course required that students practice scientific communication, both oral and written. Students needed to be able to modulate their message for different audiences and to present their information professionally. This indicated that multiple deliverables required both oral and written communication components in some form that related to the learning activity as well.

Given these constraints, the author in their role as curriculum developer started with one set of learning objectives immediately after Immersion and ended with another set of learning objectives four months later as the course commenced (Appendix A). As collaborators were introduced to the course content and materials, the learning objectives underwent edits to bring out the disciplinary specific information that they would bring to the course. The learning objectives were framed within the context of future careers as a practicing scientist in order to give relevance to the class. Additionally, data literacy was threaded throughout the course. Finally, the primary focus of the course changed to critical thinking using information within context, which provides the relevance that students were requesting in previous years' course reviews.

In many ways, the course moved from a series of IL exercises to informed learning (Bruce & Hughes, 2010) framed within the context of disaster response. In order to create the context, it was important that the students be given real-world tasks and assignments grounded in both IL theory and practice. For this to happen, the curricular developer turned to collaborations with disciplinary faculty and research laboratories, as well as government agencies.

DEVELOPING COLLABORATIONS

The disciplinary professor was paired with the author by their home department as part of the department's service to the College of Science. Given this foundational partnership, the transformations to the curricula began. This professor and the author then pursued collaborators across campus and around the state and the US, identifying individuals or research groups who had relevant career or research experience that would enhance the educational goals of the class or build upon existing partnerships within the course context. Generally if a new partner was identified by one teaching team partner, the other partner was open to contacting the collaborator, even if the timing was after the beginning of the semester or if the new collaborator might change the instructional thread of the course.

An example of this is the research laboratory VACCINE (Visual Analytics for Command, Control, and Interoperability Environments). This Department of Homeland Security Center of Excellence develops tools to analyze social media in ways that enhance the ability of government agencies to respond to emergencies. The collaboration with VACCINE started in 2013 and began with conversations about what VACCINE may have to offer to enhance the DIL portion of our course. For VACCINE, the collaboration demonstrated impact of their research on the university, on teaching in courses (which could be included in annual reports to their funding agency) and on a potential pool of future research personnel. Upon meeting with VACCINE, the original capstone course altered fundamentally as demonstrated below in the subsection titled "Curricular Development Through Collaboration."

A partnership with the National Weather Service (NWS) Office in Indianapolis, IN also altered the curricula. Each semester, representatives of the NWS's office visited the class and discussed not only their work predicting severe storms but also their use of social media to spread awareness of weather and to build weather readiness among the residents of their region. During one visit, the students demonstrated the research they were doing into social media use during severe weather outbreaks. This overlaps with a major duty of the NWS office. (One of the individuals who lectures to the class is in charge of the NWS social media presence.) The NWS expressed interest in a project that would identify the most impactful keywords for use on Twitter and Facebook during severe storm outbreaks. The author and disciplinary faculty member created the assignment, and students completed it during that semester. The NWS officers visit in late January or early February, well into the semester, which means that this assignment was created in response to the need of the collaborator as the semester was in progress.

CURRICULAR DEVELOPMENT THROUGH COLLABORATION

Collaborations enriched the curriculum of this course. They provided the primary tools the students work with to complete capstone projects, extra credit assignments that provided real world applications of fundamental concepts taught in the class, and opportunities to practice critical thinking and IL skills in a "real world" context.

In an example of how collaborations can completely change a course curriculum, in November 2012, the final capstone project description was as shown in Appendix B. The project asked students to create an ecological forecast for a natural hazard and to predict the impact of that hazard on human society in the future. The capstone required secondary literature searching, critical thinking, and scientific communication, as well as individual reflection. However, the assignment did not create an authentic learning product that would engage the students' interest.

Then in late November 2012, the disciplinary professor and curriculum designer met with VACCINE for the first time, to learn about their visual analytics software. At the time, the disciplinary professor was building a research collaboration with the former mayor of the town of Greensburg, Kansas which had experienced widespread devastation from an EF5 tornado in 2007. He described this off campus collaboration to the VACCINE personnel and they expressed interest in using their software package VALET to model a natural disaster, a use case they had yet to try.

Working with VACCINE, the teaching team rewrote the capstone project to create an assignment that used the VALET software package and data the students would gather from a variety of sources to create a visualization of the damage caused to the town of Greensburg by the tornado. The resulting assignment description is included in Appendix C. The project still required the use of IL skills to identify government information and scientific literature. However, the resulting product (in the form of a map and presentation) required synthesis of facts, critical thinking, and communication by oral presentation. The resulting activity is an organic, embedded IL activity from an informed learning perspective. It used the disciplinary context to teach IL in a way that was engaging by requiring the students to collaborate not only within their immediate team but also across the entire class to create the files that generated a map of the disaster-impacted area. The teams also collaborated with VACCINE personnel, faculty at Purdue, and individuals in the town of Greensburg, KS. This assignment resulted in a unique product that bridged the technical content of the collaborators, the disciplinary faculty co-instructor, and the information enrichment introduced by the information scientist. It represented the rich opportunities that arise when collaborations embed within a course.

In turn, the author and disciplinary co-instructor witnessed greater engagement within the course on the part of the students. They showed extensive creativity and effort in creating excellent deliverables, and improved attendance. This observational data indicated that the course revision toward active learning, informed learning, and activities built around skills building improved the students' experience.

IMPLICATIONS FOR EMBEDDED IL COURSES

Collaboration with disciplinary faculty and research groups present many opportunities for enriching IL or DIL pedagogy. The application of information in a relevant and/or immediately practical way is appealing to students, particularly when the results can be highlighted on a resume or featured in a portfolio.

Working with disciplinary faculty and research groups does require significant flexibility on the part of the course designer. Frequently, faculty or researchers have tools at their disposal which can alter how a learning objective is presented. A willingness to compromise on the inclusion of new or edited learning objectives to include the skills that the collaborators have to offer is key. Flexibility in the curricular designer's conception of what the semester will contain and how it will operate is important. In the author's experience, these collaborations generally appear just before the semester starts or as class is in session, meaning that the course designer must be willing to edit the assignments and/or presentations just prior to the beginning of class or after the syllabus distribution. This late emergence happens for a number of reasons but a primary reason is that many faculty are on break just prior to the start of the academic semester and are not available for consultation until just prior to the commencement of instruction. A willingness to work with opportunities as they arise is key.

This addition of collaborator input also means that the curriculum changes each semester it is presented. New collaborators were added as previous collaborators were unavailable. The course became a reflexive process of revision wherein it changed in response to the current roster and the available suite of tools.

Additionally, the topic of the course changed the content as well. The course subject focused on natural hazards and occurred during the spring semester, a likely time for severe storms. If a severe storm outbreak happened while the class was in session, the teaching team would discard the existing course plan and instead have the students perform real time storm-tracking and social media analysis of areas impacted by the storms.

For many librarians, the chance to offer input on a course curriculum to enhance IL instruction is a Holy Grail situation. Once librarians become instructors of record they have the chance to model that type of collaboration in which other disciplinary faculty members and researchers share their expertise in order to enhance IL instruction in the context of the course. It offers insight into what the instructor of record is facing in a last minute integration of or tweak of an assignment. It also helps to articulate the value proposition for editing a curriculum to another faculty member if the librarian has previous experience with the details of how that is accomplished.

This process requires one to identify the work that goes into re-designing a course. Someone will have to take the lead on the revision of the syllabi, assignments, and guidance for students. Another (possibly not the same person) will have to take the lead in communicating with collaborators and ensuring that they are on board with their portion of the curricula, whether delivering a lecture, recording a flipped lecture, creating an assignment, leading in-class activities, or collaborating with students to ensure the completion of deliverables. Communication regarding workflows and tasks is key in this type of course and it is important that the communication of roles be clear. Collaboration doesn't mean that one individual does all of the work but it does mean that there will likely be a point person in charge of the curriculum to ensure that it is ready to present to students in class.

CONCLUSION

Collaborations with disciplinary specialists enhance the relevance of IL and DIL instruction. Such collaborations also demand flexibility and creativity, as the new materials and tools introduced by the collaborations change and morph not only assignments but learning objectives. The resulting experience was a growth opportunity for the curricular developer and a richer learning environment for the students.

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APPENDIX A

Learning Objectives – Before and After

Before collaborator input, the learning objectives were phrased as:

Students will:

1) develop a search strategy in order to efficiently find information.
2) find academic papers in order to complete assignments and gather supporting information for their educated opinions.
3) construct a citation in order to restate the components of a citation and their purpose.
4) apply teaming techniques in order to develop a tool kit for future teamwork.

After collaborator input, the learning objectives were phrased as:

The course will foster the development of the skills necessary to make a critical evaluation of complex issues facing society. Issues will be examined from scientific, economic, political, and ethical viewpoints. Students will learn to examine the issues from these different perspectives and to draw conclusions based (in part) on scientific evidence.

I. Students will enhance their information literacy skills. The science and economics pertaining to the issues examined in this course are subject to rapid change. In order to talk and write knowledgeably about these issues, one must be able to find current and reliable information, evaluate its validity and applicability, and integrate it into ones existing understanding of the issues.

II. This course strives to emphasize the interrelationship between the various issues examined. Students will leave this course with an understanding how and why the issues are linked and cannot be viewed as problems to be solved separately. Similarly, these problems are not the province of a single discipline, but rather all disciplines have to be involved to contribute to the solution of these issues.

III. Students will demonstrate the ability to write and speak knowledgeably and persuasively about the issues.

IV. Students will use statistics and data ethically in the discussion of great issues.

V. Students will work as an active and contributing member of a team.

The learning objectives map to each other in the following manner:

Learning Objective Functional Map		
Concept	**Original Learning Objective**	**Edited Learning Objective**
Efficient information retrieval	1)	I.
Use academic literature	2)	I.
Use other supporting information	2)	I.; IV.
Construct a citation	3)	
Apply teaming techniques	4.	V.
Critical thinking		Primary Learning Goal; I.; II;
Current Awareness		I.
Evaluation of information		I.
Oral/Written Communication		III.
Statistical Literacy		IV.
Data Literacy		IV.

APPENDIX B

Original Capstone Project Description Prior to Collaboration with Faculty and Research Group

Ecological Forecast (group) – Students will select one example of a natural hazard and, using data to back their opinion, develop an ecological forecast for that natural hazard. The following facets may be considered: local vs. global, near future versus extended future, impact on climate, environment/wildlife, human society (politics, economics, policy). Student groups will submit an abstract, poster, and 5 page paper. The abstract will briefly describe the results of the research. The poster will highlight visual displays of data that support the group findings. The five page paper will describe the data that was collected and how it lead to the conclusions that the group formulated. The paper will include a bibliography in APA style. Individuals will submit a self-assessment.

The self-assessment is a brief 1 page paper containing:

The most important parts of the research assignment as perceived by the student, their own assessment of how well they have done, and how they know that they have done well or poorly. Give 1 or 2 examples of the most successful research techniques or "finds". Explain what made those successful. Give 1 or 2 examples, of less successful research techniques or sources. Why were they less successful? What if anything could the student do differently to increase learning, research methods, and productivity?

APPENDIX C

Final Capstone Project Description After Collaboration with Faculty and Research Group

SCI360 Team project: a visual analytical journal of the destruction and recovery of

Greensburg Kansas.

150 points.

Overview: In the final project for this course you will be integrating data obtained from multiple sources that will allow us to document and visualize the initial destruction and the progressive recovery of Greensburg Kansas. The student body, broken up into 16 small working groups of 4 to 5 students each, will be in charge of mining data from a variety of sources, synthesizing the data found, and reformatting the data for use in the visualization. We will be approaching the data gathering by clustering data into important categories that relate to how facets of life in Greensburg are recovering at different rates. These categories are part of the discussions we've had in class and are listed below. Our project goal is the conversion of this data into appropriate formats that will permit generation of data layers that can be mapped onto the town of Greensburg and thus to generate a visual journal of destruction and recovery in that town that may provide decision makers of that town tools for future hazard and development planning.

The resources at your disposal are the computer labs in MTHW 116 and HIKS 980C during Tuesday and Thursday normal class periods, respectively. Additionally, Dr xxxx of Purdue's Library System and yyyy of Purdue's VACCINE Homeland Security Center are consultants on this project and will be guiding specific team members on how to convert data into shape file for GIS layers and the integration of those shape files with visual analytics software in VACCINE.

Based on the in-class discussions (March 19 brainstorming session where the class participants ranked the most important data needed to catalog destruction recovery in this town, the following list represents the categories you are responsible for investigating as your team project. For funsies, the exact terms submitted by you all on March 19 were converted into a WORDLE shown on the cover page to this assignment. Note, each of these categories may have a time (initiation and duration), geographic location, specific agent or source (i.e. individual, corporation, or agency), recipient (private, public), etc. and you will be responsible for collecting the data, properly categorizing it, and converting into a usable format. Team and project assignments are in the attached table.

1. Federal-state disaster declarations

2. Tornado damage path and debris field

3. Aid to Greensburg Kansas (i.e. federal, state, private corporate)

4. Basic services

5. Groundbreakings (i.e. businesses, social and basic services, third spaces, homes).

The Assignments: Some of this data, you will be obtaining from open web sources such as American FactFinder and FEMA. Other data comes directly from the Mayor's office of Greensburg Kansas. This information will arrive in a variety of formats and most likely none of it directly usable as is obtained. For instance, data set #1 represents milestones of recovery and destruction that the people of Greensburg felt important enough to document and write down in a collective journal. This list was sent to us by the city manager and members of the town have added to this list over the past five years. Each milestone has a timestamp, an important activity or event, and in some instances the reference to a business or building that you will be responsible for finding the address (pre- and post- disaster if applicable) and then the latitude/longitude of the geo-referenced place. This data then will be converted into shape files and then GIS layers. Much of this work can be done during normal class time and you will have access to computer labs to ensure you have Internet capability.

In the next two weeks you will be introduced to faculty and staff from Purdue Libraries and VACCINE Homeland Security program who will help us to generate the final product.

The project deliverables will be in four steps.

1. Production of comprehensive data sets that are categorized by time, georeferenced and converted into the proper format to permit the generation of shape files.
2. Conversion of these data sets into GIS layers specific for the Greensburg site.
3. Synthesis of GIS layers into a disaster/recovery journal of the above categories.
4. The presentation of this recovery journal to the class.
This final presentation will be done during the final examination time/day.

In addition to the data files, each group member will be responsible for communicating research accomplishments/sources of information/reflection on the process via the Final Project group on Blackboard. Using the group Journal tool, each person is responsible for documenting their personal contributions to this project. Consider answering questions such as: what has proven valuable in this process? what difficulties are emerging? what are you looking for that you are having difficulty discovering? what information would you request from the town of Greensburg that would make this a more complete picture? what aspects of the search are surprising? and what do you feel you do not know how to do that is making this process confusing or difficult? This is not an exhaustive list of potential topics. We are looking for evidence that you are thinking critically about this project and applying reflection to improve your search practice. The entries to the group journal are worth 50 points for each individual student and is not a group grade.

Data Formatting

The data will be in two types of files: shape files and excel files. The shape files will provide the underlying maps for the visualization and the excel files will contain the event description, geolocation, time, and category (1-5 listed above).

All spreadsheet files should be formatted in the following way:

An example from the Greensburg Journal might look like this:

Date	Event description	Geolocation (latitude/longitude)	Category	Time (if available)
5/12/2007	Lights turned on at baseball diamond	N 37° 36' 31.1006" W 99° 17' 6.6672"	Basic Services	

Geolocation can be found by address or by browsing to the location on a web based mapping service such as Google Earth.