New maps in the new medium: Teaching web cartography for a distributed workforce

R.G. Donohue [a], M.W. Wilson [b]

[a] Department of Geography, University of Kentucky, Lexington, KY – rgdonohue@uky.edu
[b] Department of Geography, University of Kentucky, Lexington, KY – matthew.w.wilson@uky.edu

ABSTRACT:

Discussions of online education often center on pervasive media, which allow for immersive and distributed education. However, when the curriculum is explicitly designed to train students in the expert use of software and systems for web cartography, how might educators best realize these opportunities in online education? We discuss two challenges: 1.) how to teach distance learners a technologically-demanding, yet cartographically-focused curriculum, and 2.) how to design and implement this curriculum within a quickly shifting landscape of workforce needs? We overview efforts to support a new generation of cartographers, enhanced with the technical capacities of open web standards, source coding libraries, and Git-enabled distributed version-control systems.

1. INTRODUCTION

The technologies of distance education should reinforce the vocational needs of our students. The delivery of course material, the submission of course assignments, the scheduling and hosting of office hours, the platforms for collaboration and project management, and the tools of feedback and assessment by faculty and peers can all be supported through the latest in learning management systems (LMS). However, there is a significant reason that those in distance education in technology fields should not utilize these systems: our students will likely never again make use of the technologies embedded in these LMS. Instead, they will use a variety of proprietary and open source systems as they apply their new technical skills and thought processes to mapping. The adoption of available industry-standard technologies within the classroom that increase collaboration—born within the very communities of practice within which students aspire to work—better prepares students for a distributed workforce.

2. LITERATURE REVIEW

Teachers have recently embraced distributed version control systems (DVCS) such as Git to serve a variety of educational needs. Though not designed as a LMS, educators now use hosting platforms such as GitHub to create, integrate, revise, and disseminate course material (Roth, 2016). GitHub additionally facilitates transparency and ease in ongoing student assessment and collaborative learning through technical features referred to as issues, branching and merging, and pull requests (Francese, et al., 2015). The GitHub profile itself becomes the de facto resume for developers and using GitHub better prepares students for the workforce by adopting industry-standard skills (Kelleher, 2014).

Appropriating GitHub for use in the classroom is challenged by a steep learning curve for both students and teachers (Feliciano, et al., 2016), as well as privacy concerns and the potential for cheating from public repositories (Griffin, T and Seals, S, 2013). However, studies indicate learning and adapting a workflow to Git is achievable (Lawrance, 2013), and tools such as desktop GUIs make Git more accessible to otherwise unconfident students and instructors (Petras, et al., 2015). The ongoing discussion among educators has shifted away from questions of whether or not it is a suitable replacement for the traditional LMS and toward the specific ways of best employing Git within courses. Yet much of the researched practice occurs within engineering and computer science curriculum and may not address the specific needs involving mapping and GIS. Given the rapid evolution of scripting libraries, standards, and platforms, further research is needed to better clarify the pedagogical implications for teaching with DVCS.

3. GITHUB IN NEW MAPS PLUS

As a new online graduate program launched in the Fall of 2015, New Maps Plus re-evaluated the available LMS and their potential role in a curriculum focused on innovative web map design and development. Rather than using the university-sanctioned LMS, faculty used GitHub repositories to build and share the emerging course content, drawn from trends identified within the professional web development workforce. Rescued from zipping directories, emailing files, and writing content in word processing systems, the technology stack used to design the courses increasingly resembled the very medium for which students were to be trained and eventually use within the workforce.

A course on web mapping now begins with students first establishing a personal GitHub account. They then follow a URL to a repository where they clone down weekly modules, begin editing and writing code, and follow the Git workflow of add/commit/push for assignments. Helping distance learners with assignments requires examining the current state of their project, a solution for which the conventional LMS is poorly equipped. Instructors instead offer help and evaluate assignment submissions using the same Git process that students practice and professionals embrace. As a result, students learn how to use the workflow in a direct and meaningful way, relegating the role of the LMS to that of a centralized record of grades and email distribution. A recently developed course on geocollaboration made further use of GitHub's features for supporting team projects.

Both the students' background experience and the curricular needs of a web cartography program differ from a traditional programming education. Students pursuing a web mapping degree come from diverse fields (including social science) and often initially benefit from desktop GUIs and lack confidence using command prompts. Yet the employment of Git and GitHub within our courses has encountered minimal obstacles. While web mapping does require learning to read and write, adjusting course deployment and student assessment to cover graphic design, geospatial data transformation, usability, and

interface design using Git required new thinking and further experimentation. Instruction in web mapping required visual aids for students to gain the tacit knowledge needed for debugging and refactoring code, in addition to smoothly integrating various GIS and development tools within a productive workflow. GitHub supports embedding videos and animated GIFs within Markdown files, though the technology does not expressly lend itself toward this end. As a text-based format, the employment of Markdown as the primary means of lesson delivery enforces a pedagogy that prioritizes careful reading of detailed explanations, supplemented through diagrams, screenshots, other media, and web-based chat systems (e.g., Slack) and screen sharing video meetings.

4. DISCUSSION

As we complete the third year of instruction in New Maps Plus, we recognize the specific opportunities of DVCS-supported online education as well as the continued challenges of this approach. In many ways, utilizing platforms like GitHub as the medium for the management of learning efforts *and* as the frequent object of instruction itself requires something quite different from our colleagues who transition their face-to-face instruction into online environments, often using LMS with pre-recorded lectures, and largely fixed and canned learning assessment tools. In contrast, the design of our courses requires more frequent maintenance between course offerings and more individualized attention between the instructor and the student.

Graduating students quickly realize one of the more obvious opportunities: through the process of learning to use Git they have gained literacy in the industry-standard workflow used for distributed and cooperative coding work used across a variety of web design industries. GitHub's support of web hosting alleviates additional hosting requirements needed to produce outward facing web portfolios that help share their skill sets with potential employers. These web portfolios demonstrate sophisticated graphic and interactive visualizations. Furthermore, engagement with Git and GitHub helps students engage with a broader creative community who find overlap through projects supported by FOSS and Git.

From the instructors' perspective, using Git eases the management of student work and assessment in web cartography and GIS in a variety of ways. Mapping education has often required managing large numbers of versioned files and scripts through compressed file formats and email correspondence while LMS require manually uploading files and clicking through various navigational pathways to post and share content. The use of Git can greatly reduce the amount of time managing the submissions (emailing, downloading, etc.), allowing more time for discussion and evaluation of students' work.

We cannot downplay the many challenges in the adoption of Git and GitHub for teaching web cartography online. Instructors must realize their learning objectives and instructional voice within the shifting features and limitations of GitHub. Negotiating a growing number of student repositories, maintaining students' privacy, addressing the potential for cheating, and convincing students to accept Git as worthwhile learning objective all compound additional work for teachers. The dreaded merge conflict, more easily avoided through experience, can be particularly overwhelming for students lacking in a more technical background and confidence using a command prompt. Desktop GUIs, while offering their own cross-platform frustrations, can fail to help facilitate a deeper understanding of the Git processes that can circumvent such merge conflicts. Yet these challenges become part of the learning opportunity as well. Mistakes made in Git, such as forgetting to branch before committing changes, can be traumatising for the uncertain and inexperienced.

5. CONCLUSIONS

One of the unresolved challenges in mapping education today is answering a set of technical questions involving *how* we practice web cartography without neglecting the conceptual and ethical questions involving *what* and *why* we do it. Students and web developers work on the edge of a technological fatigue, negotiating a continual stream of new libraries, frameworks, and solutions. Keeping pace with the state-of-the-art risks exhaustion and is an intimidating barrier to newbies attempting enter the field. The introduction of yet another steep technical learning curve such as Git must yield great rewards to warrant its inclusion in the educational tools we prioritize. We suggest that this yield is doubled when integrated within a course as to be the medium for learning web cartography and GIS.

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