A how-to guide for teaching GIS courses online with hardware or software in the cloud

August 19 2020, by Forrest Bowlick

In the current remote learning era, Forrest Bowlick at UMass Amherst and others provide expert insight into how to set up a virtual computing environment in different modes: with hardware and with software in the cloud. Credit: UMass Amherst/Forrest Bowlick

In a new paper this week, geographer Forrest Bowlick at the University of Massachusetts Amherst and colleagues at Texas A&M offer first-

hand accounts of what is required for GIS instructors and IT administrators to set up virtual computing specifically for providing state-of-the-art geographic information systems (GIS) instruction.

Bowlick says, "Our research is very applicable in the current remote learning era that we're working through, because it provides expertly driven insight into how to set up a virtual computing environment in different modes: with hardware and with software in the cloud. While tailored to those needing GIS support, it is also very applicable for other high-performance software needs."

"By capturing the experiences of both setting up the system and of students using the system, we provide an important resource for others needing to make this investment of time, equipment and energy," he adds. Such technical practice is becoming required for GIS and other instruction, he points out.

Writing in the *Journal of Geography in Higher Education,* the authors compare an onsite server set-up and a virtualized cloud set-up scenario and report some student feedback on using a course taught this way. The growing need for fast computers, they point out, has made it harder for everyone to build the machines they need. "Our work talks about how to build fast computers in different ways and shares what we know about making fast computers for digital geography," Bowlick notes.

He says, "UMass is just one of several programs nationally, but regionally it's very attractive, especially at the graduate level, because there are not that many in New England. Ours certainly started at the right time, too. With the turn toward using more computational skills and GIS practices, how to use different computer constructs and programming language are become more fundamental needs in education."

Bowlick has directed a one-year M.S. geography degree program with an emphasis in GIS at UMass Amherst since 2017. He says there may be 10 or 15 students from every college on campus with different majors in the introductory course in a given semester. They need to gain fundamentals of spatial thinking, operating software and problem solving applicable to the diverse interests that students bring to the course.

Generally, these applications involve how to think through spatial problems on such topics as political geography, for example, which might ask who is voting and where, or on gerrymandering and how to discover it. Others are creating COVID-19 virus maps and spatial data to show its prevalence for spatial epidemiology and health geography, while others are modeling ecosystems for fish and wildlife.

Bowlick explains that geographic information science is "a bridging science"—a suite of technologies, a way of thinking and a way to store spatial data including satellite systems for navigation. GIS handles imagery, computer mapping, spatial planning, modeling land cover over time, even helping businesses decide where to open their next location.

GIS was first developed in the late 60s when the Canada Land Inventory needed ways to store, manage and analyze land resource maps over huge areas using new computer technology, Bowlick says. His two co-authors at Texas A&M, both experienced GIS instructors, are Dan Goldberg, an associate professor in geography, and Paul Stine, an IT system administrator for geography.

The authors describe the setup, organization and execution of teaching an introductory WebGIS course while considering student experiences in such a course.

The paper also defines an operational set of resource metrics needed to support the computing needs of students using virtual machines for

server-based CyberGIS classes, as well as comparing costs and components needed to build and support an on-premise private cloud teaching environment for a WebGIS course in an on-premise private cloud teaching environment vs. a comparable cloud-based service provider.

More information: Daniel W. Goldberg et al, Virtualization in CyberGIS instruction: lessons learned constructing a private cloud to support development and delivery of a WebGIS course, *Journal of Geography in Higher Education* (2020). DOI: 10.1080/03098265.2020.1802704

Provided by University of Massachusetts Amherst