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Preliminary remarks
How might location awareness and analytics enrich online learning across disciplines?

I'd like to explore this question in the context of challenges facing geography/geospatial teacher education.

Researchers have identified many factors and conditions impeding the adoption of geospatial data and technology in secondary education. Kerski (2001), through a survey of over 1,500 teachers who had acquired GIS software, found that 45% were not using GIS in the classroom even though they owned the software. More recently, a survey of in-service teachers who received professional training in GIS found that 40% of them still did not teach with the technology, whereas others continued to experience difficulties using GIS to teach inquiry skills and methods of spatial analysis (Baker, Palmer, & Kerski, 2009). Although many of these teachers express genuine enthusiasm for geospatial teaching, their efforts are often undermined by insufficient access to spatial data, mentors and peer support (Charles & Kolvoord, 2003; Crechiolo, 1997; Donaldson, 2001; Kerski, 2000; Palladino, 1994; Storie, 2000).

Findings such as these strongly suggest that in-service teacher training, while unquestionably essential, is not enough to ensure that geospatial data and technology become widely adopted for instructional purposes in STEM classrooms. More focus is needed during the pre-service stage of teacher education and the first few years of classroom teaching, a formative time when early career teachers deepen and extend subject matter knowledge, refine their instructional repertoire, and develop technical and pedagogical skills with different forms of educational technology (Cattani 2002; Feiman-Nemser 2001). Based on what is known from the existing research literature, it appears that teachers trained with geospatial data and technology at the very beginning of their professional preparation are more likely to continue using these resources, materials and tools (RMTs) well into their professional teaching careers (Avard, 2009; Baker, Palmer, & Kerski, 2009; Barnett et al. 2010; Trautmann & MaKinster, 2010; Wilder, Brinkeroff, & Higgins, 2003).

Location awareness and analytics offer a promising means of customizing the delivery of online geography/geospatial teacher education to reflect state-by-state professional development and certification requirements. At either the middle school (grades 6-8) or high school level (grades 9-12), geography may be present as a strand within social studies standards or as a separate set of standards (sometimes paired with history), often linked to a course (Grosvenor Center for Geographic Education, 2012):

- Elementary grades (K-5): Geography mostly integrated with social studies disciplines.

- Middle School (grades 6-8): 18 states either require or make optional a geography or geography/history course. 11 states have no geography requirement, while individual districts in 22 states may require geography.

- High School (grades 9-12): 27 states either require or make optional a geography or geography/history course. 7 states have no geography requirement, while individual districts in 17 states may require geography.

Pre-service STEM teacher preparation is fundamentally out-of-sync with the interdisciplinary character of geospatial data and technology. All too often teachers fail to obtain adequate preparation in the technological, pedagogical, and disciplinary content knowledge areas that are foundational to effective teaching with geospatial data and technology in STEM (Hauselt & Helzer, 2012). Although pre-service teachers in math, science and geography may learn *about* geospatial data and technology in their undergraduate disciplinary courses, these courses do not address how to teach *with* geospatial data and technology (Alibrandi & Palmer-Moloney, 2001; Kerski, Demirci, & Milson 2013). Until this situation changes, geospatial data and technology will remain "boutique" RMTs used only by those teachers fortunate enough to receive comprehensive professional development in geography, geospatial technology, and related teaching methods.

Instead of "stove-piping" different aspects of geospatial teacher preparation across different disciplines, a better approach would be to provide interdisciplinary professional development that ensures maximum access to the best possible professional training available (indeed, the value of such an interdisciplinary approach is at the heart of *Geography for Life, 2nd edition* and the other STEM curriculum standards and frameworks). Fulfilling this vision will require coordinating the efforts of academic geographers, educational methods faculty, and geospatial technology educators to create online RMTs providing the right balance of preparation in technological, pedagogical, and disciplinary content knowledge areas. It also means ensuring these aspiring teachers have the flexibility to access this professional preparation and mentoring through a variety of online, customizable delivery systems as part of their pre-service methods courses.

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