

Teaching Geographic Information Science and Technology in Higher Education



Editors 160

David Unwin | Kenneth Foote | Nicholas Tate | David DiBiase

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David, formerly professor of geography at Birkbeck College in the University of London is now retired. He was one of the team that established the *Journal of Geography in Higher Education* and in 2006 received recognition from the US *University Consortium for Geographic Information Science* as *Educator of the Year*. In 1999 his work in establishing its continuing professional development scheme led to the award of the UK *Association for Geographic Information's Past President's Prize*. He has experience of teaching GIS&T in universities in the UK, Canada, New Zealand and the USA. With David O'Sullivan he is co-author of *Geographic Information Analysis*, also published by Wiley.

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Ken is a professor of geography and former department chair at the University of Colorado at Boulder. His interests focus on improving geography in higher education, learning technologies, and GIScience, particularly multimedia cartography. He has served as president of both the *Association of American Geographers* (AAG) (2010-11) and *National Council for Geographic Education* (NCGE) (2006). He edited the *NCGE Pathways* series for geography educators (2000-05) and was the North American editor of the *Journal of Geography in Higher Education* (1999-2003). He received the AAG's Honors in Geographic Education in 2005.

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Nick is senior lecturer at the Department of Geography, University of Leicester. He was PI and Director of the Spatial Literacy in Teaching (SPLINT) CETL from 2005-10, where he directed the pedagogic activities across the consortium (University of Leicester, University of Nottingham and UCL)

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David DiBiase

David led the *Penn State Online* certificate and Master of GIS degree programs in GIS from their inception in 1998 until 2011. The certificate program earned ESRI's *Special Achievement in GIS* award in 2004, and the masters program earned the *Sloan Consortium's* 2009 award for *Most Outstanding Online Teaching and Learning Program*. David led the editorial teams that completed both the UCGIS *GIS&T Body of Knowledge* and the US Department of Labor's *Geospatial Technology Competency Model*. He participated in the URISA Certification Committee that helped established the GIS Certification Institute, and served as GISCI President from 2010-11. In August 2011, David moves to Esri as Director of Education, Industry Solutions.

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Foreword

Information about the Earth's surface, about the nature of places and the routes that connect them, is vital to almost all aspects of life today. For centuries such information has been captured and disseminated in the form of maps, but in recent decades a suite of new tools and technologies has become available that has vastly increased the range of what can be captured and how it is applied. Today we make constant use of the Global Positioning System, online mapping services such as Google Earth, imagery captured by Earth-orbiting satellites, and the analytic capabilities of geographic information systems. Moreover the need to solve problems that arise in developing and using these geographic information technologies, and the need to discover general principles that can be used to improve them, are of sufficient significance and difficulty as to constitute a research field of their own, a field known as geographic information science (GIScience).

One of the most pressing of the problems of geographic information science and technology (GIS&T) concerns representation: how to design an effective and efficient way of capturing the infinite complexity of the geographic world in the absurdly limited space and two-character alphabet of a digital computer. We have learned over the past four decades that such designs involve a host of choices: what to capture and what to leave out, which of innumerable coding schemes to use to convert geographic reality into a binary sequence, and how to make the result understandable by any application system. GIS&T is not a simple matter of a few rules, but a complex world of nuanced alternatives that requires an understanding not only of the technology, but also of the geographic world that the technology is attempting to represent. The fundamental principles of

GIScience include some that reflect the nature of computational systems, and some that concern the ways in which the geographic world itself is organized.

Just as there are numerous choices in GIS&T, so also are there numerous choices in how GIS&T is taught. How should we balance training in the technical details of today's technology, with education in the principles, that will still be true when today's technology is a memory? Who are we teaching: the researchers of tomorrow or the next generation of practitioners? How should we balance open-source and commercial software products, and how should students be exposed to them? What is the appropriate mix of lecture, practical exercises, and individual or group projects?

When I started a course in GIS&T over thirty-five years ago I had little doubt of who my audience was: university students majoring in geography who would go on to careers in the fields traditionally staffed by professional geographers, as teachers, environmental consultants, or location analysts. Even then, knowledge of the rapidly expanding field of GIS&T would give them a valuable edge in competing for such jobs. Courses like this proliferated, and GIS&T slowly evolved into a recognized professional qualification. Yet today the situation we face could not be more different. In addition to an ever-increasing demand for professionals, universal access to at least a minimal set of geographic information services has raised a different set of questions: in addition to asking what the professional needs to know, we also need to be asking what *every* well-educated citizen needs to know. While online mapping tools may appear to make working with digital geographic information easy and straightforward, in reality it is all too easy to make mistakes and false inferences, to endanger personal privacy, and to engage with many other ethical issues. We teach mathematics and language skills to