Andrew J. Milson
Ali Demirci
Joseph J. Kerski *Editors*

International Perspectives on Teaching and Learning with GIS in Secondary Schools

Springer

International Perspectives on Teaching and Learning with GIS in Secondary Schools

Andrew J. Milson · Ali Demirci · Joseph J. Kerski
Editors

International Perspectives on Teaching and Learning with GIS in Secondary Schools

Foreword by Roger Tomlinson

Springer

Editors
Andrew J. Milson
University of Texas at Arlington
601 South Nedderman Drive, Box 19529
Arlington
Texas 76019
USA
milson@uta.edu

Ali Demirci
Fatih University
Department of Geography
Buyukcekmece, Istanbul
Turkey
ademirci@fatih.edu.tr

Joseph J. Kerski
Environmental Systems Research Institute
1 International Court
Broomfield
Colorado 80021-3200
USA
jkerski@esri.com

ISBN 978-94-007-2119-7 e-ISBN 978-94-007-2120-3
DOI 10.1007/978-94-007-2120-3
Springer Dordrecht Heidelberg London New York

Library of Congress Control Number: 2011937059

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

Geographic Information Systems (GIS) are in use worldwide – over 400,000 institutions in over 125 countries use them on a daily basis (based on the actual licenses sold by major GIS software manufacturers). Millions of people work in the geospatial industry, estimated at $64 billion per year by the US Department of Labor, and growing at 20% per year. However, in my estimate, the current production of GIS trained students from all educational institutions, secondary and tertiary, does not keep up with the growing demand. In fact, the global uptake of this productive and exciting technology is determined by the supply of trained people able to use it effectively.

Geographic Information Systems are contributing to every imaginable activity across the administrative, military, and scientific spectrum. The technology has demonstrated significant benefit to those organizations, countries, and cultures that use it. Clearly education is a critical component in the future of the nations involved. GIS education in secondary schools is the foundation of this progress.

This book tells stories from many countries describing their experience with bringing GIS education into the high school. It is a description of real-world experience from which lessons can be extracted. It brings the realization that GIS education is far more than developing skills needed in the workforce. It shines a light on the importance of inquiry-based teaching, where GIS is the enabling tool that allows students to engage in meaningful issues about their environment, time, and place. GIS education leads to critical thinking in a wide range of disciplines, and is fundamental to the creation of decision-makers. This emerges as a persistent theme in the experiences that are related from widely different institutional settings and cultural backgrounds.

This is an important book, of value not only to students, parents, and teachers, but also to the leaders in pedagogy, curriculum, and organizational policy in the world of education.

Tomlinson Associates Ltd, Ottawa, Canada Roger Tomlinson

Acknowledgments

The editors are thankful to Springer for publishing this long overdue global perspective on GIS in education. We wish to express our sincere gratitude to Bernadette Ohmer from Springer for her support of and assistance with this project. We also appreciate the external reviewers selected by Springer who provided extremely helpful feedback. The authors have gained tremendous respect for one another in the process of producing this volume. Each has been grateful to work with such a diligent team of co-editors. Finally, we salute the visionary educators who have introduced GIS to young people around the world and who have contributed their valuable time to share these stories. We believe that the students they have worked with around the world will be well-equipped through their work with GIS to enable a brighter future for the planet and its people.

– Andrew J. Milson, Ali Demirci, and Joseph J. Kerski

Contents

Contributors

Svein Andersland Akvator, Stord, Norway, sa@akvator.no

Maria Attard University of Malta, Msida, Malta, maria.attard@um.edu.mt

Jim Ayorekire Makerere University, Kampala, Uganda, jayorekire@arts.mak.ac.ug

György Borián Danube-Drava National Park, Hungary, gy.borian@freemail.hu

Gregory Breetzke University of Canterbury, Christchurch, New Zealand, gregory.breetzke@canterbury.ac.nz

Mohamed R. Bualhamam United Arab Emirates University, Al Ain, United Arab Emirates, mbualhamam@uaeu.ac.ae

Theodore Burikoko Kigali, Rwanda, buritheo@yahoo.fr

Alfredo del Campo Instituto Geográfico Nacional (IGN), Madrid, Spain, adelcampo@fomento.es

Joan Capdevila Instituto Geográfico Nacional (IGN), Catalonia, Spain, joan.capdevila@mpr.es

Victoria Castro De la Rosa Education Ministry, Santo Domingo, Dominican Republic, victoriacastro@gmail.com

Chris Charman Huron Heights S.S., Kitchener, ON, Canada, chris_charman@wrdsb.on.ca

Che-Ming Chen National Taiwan Normal University, Taipei, Taiwan, jeremy@ntnu.edu.tw

Ali Demirci Fatih University, Istanbul, Turkey, ademirci@fatih.edu.tr

Natalia Andrea Diaz Vega Universidad Distrital F.J.C., Bogotá, D.C. Colombia, nataliadiazv@gmail.com

Pinliang Dong University of North Texas, Denton, TX, USA, Pinliang.Dong@unt.edu

Stephanie A. Eddy GISMAPED, Auckland, New Zealand, stephanie@gismaped.co.nz

Sanet Eksteen University of Pretoria, Pretoria, South Africa, sanet.eksteen@up.ac.za

Mary Fargher Institute of Education, University of London, London, UK, m.fargher@ioe.ac.uk

Tim Favier VU University, Amsterdam, The Netherlands, t.favier@ond.vu.nl

Martina Forster Esri Deutschland, Kranzberg, Germany, m.forster@esri.de

Sylvain Genevois Institut National de Recherche Pédagogique, Lyon, France, sylvain.genevois@inrp.fr

Iain Greensmith Esri Canada, Toronto, ON, Canada, igreensmith@esricanada.com

Niem Tu Huynh Association of American Geographers, Washington, DC, USA, nhuynh@aag.org

Yoshiyasu Ida University of Tsukuba, Tsukuba, Japan, ida@human.tsukuba.ac.jp

Thomas Jekel Institute of GIScience, Austrian Academy of Sciences, Salzburg, Austria, thomas.jekel@oeaw.ac.at

Torben P. Jensen Langkær Gymnasium and HF, Tilst, Denmark, tpj@tpj.dk

Tino P. Johansson University of Helsinki, Helsinki, Finland, tino.johansson@helsinki.fi

Thierry Joliveau Jean Monnet University of Saint Etienne, Saint Etienne, France, thierry.joliveau@univ-st-etienne.fr

Joseph J. Kerski Esri, Broomfield, Colorado, USA, jkerski@esri.com

Minsung Kim Texas A&M University, College Station, TX, USA, minsungkim@neo.tamu.edu

John C. Kinniburgh The King's School, Sydney, NSW, Australia, jck@kings.edu.au

Arne Frank Knudsen Laksevåg Upper Secondary School, Bergen, Norway, arnknu@hfk.no

Alfons Koller University of Education, Linz, Austria, kol@ph-linz.at

María Luisa de Lázaro Universidad Complutense de Madrid (UCM), Madrid, Spain, mllazaro@ghis.ucm.es

Sang-Il Lee Seoul National University, Seoul, South Korea, si_lee@snu.ac.kr

Peiying Lin Capital Normal University, Beijing, China, pylin2000@263.net

Yan Liu University of Queensland, St. Lucia, Queensland, Australia, yan.liu@uq.edu.au

Andrew J. Milson University of Texas at Arlington, Arlington, TX, USA, milson@uta.edu

Gustavo Moreira-Riveros Ministry of Education, Santiago, Chile, gmoreirar@gmail.com

Madalena Mota Pinhal Novo Secondary School, Pinhal Novo, Portugal, madalenamota@gmail.com

Osvaldo Muñiz-Solari Texas State University, San Marcos, TX, USA, o.muniz@txstate.edu

José Antonio Nieto Instituto de Cartografía de Andalucía, Seville, Spain, jantonio.nieto@juntadeandalucia.es

Albert Nsengiyumva Workforce Development Authority, Kigali, Rwanda, ansengiyumva@wda.gov.rw

Benjamin Ofori-Amoah Western Michigan University, Kalamazoo, MI, USA, ben.ofori@wmich.edu

Anne F. Olsen Chilton Saint James School, Lower Hutt, New Zealand, anne@gismaped.co.nz

Joseph R. Oppong University of North Texas, Denton, TX, USA, Joseph.Oppong@unt.edu

Quinta Ana Pérez Sierra Instituto Tecnólogico de las Américas, Santo Domingo, Dominican Republic, qperez@gmail.com

Erika Pretorius University of Pretoria, Pretoria, South Africa, erika.pretorius@up.ac.za

David Rayner Institute of Education, University of London, London, UK, D.Rayner@ioe.ac.uk

Luz Angela Rocha Salamanca Universidad Distrital F.J.C., Bogotá, D.C. Colombia, lrocha@udistrital.edu.co

Jan Ketil Rød Norwegian University of Science and Technology, Trondheim, Norway, jan.rod@svt.ntnu.no

Concepción Romera Instituto Geográfico Nacional (IGN), Madrid, Spain, cromera@fomento.es

Eric Sanchez Université de Sherbrooke, Sherbrooke, Québec, Canada, eric.sanchez@usherbrooke.ca

John A. Schembri University of Malta, Msida, Malta, john.a.schembri@um.edu.mt

Henk J. Scholten Geodan, Amsterdam, The Netherlands, henk@geodan.nl

Bob Sharpe Wilfrid Laurier University, Waterloo, ON, Canada, bsharpe@wlu.ca

Alexander Siegmund University of Education Heidelberg, Heidelberg, Germany, siegmund@ph-heidelberg.de

Hans-Jörg Stark University of Applied Sciences Northwestern Switzerland, Muttenz, Switzerland, hansjoerg.stark@fhnw.ch

Josef Strobl Center for Geoinformatics University of Salzburg, Salzburg, Austria, josef.strobl@sbg.ac.at

Geok Chin Ivy Tan National Institute of Education, Nanyang Technological University, Singapore, Singapore, ivy.tan@nie.edu.sg

Vinod Tewari TERI University, New Delhi, India, vinodt@teri.res.in

Chetan Tiwari University of North Texas, Denton, TX, USA, Chetan.Tiwari@unt.edu

Jean Tong Esri Canada, Toronto, ON, Canada, jtong@esricanada.com

Carmen Treuthardt Association of Swiss Geography Teachers, Switzerland, Carmen.Treuthardt@edulu.ch

Revocatus Twinomuhangi Makerere University, Kampala, Uganda, levtwin@arts.mak.ac.ug

Joop van der Schee VU University, Amsterdam, The Netherlands, j.vanderschee@ond.vu.nl

Kathrin Viehrig University of Education Heidelberg, Heidelberg, Germany, viehrig@ph-heidelberg.de

Xi Xiang National Institute of Education, Nanyang Technological University, Singapore, Singapore, shellyxiang1203@gmail.com

Rawan Yaghi Nabil Adeeb Sleiman Secondary Public School, Bednayel-North Bekaa, Lebanon, rawan.yaghi@gmail.com

Minori Yuda University of Tokyo, Tokyo, Japan, minori@csis.u-tokyo.ac.jp

List of Figures

List of Tables

About the Editors

Ali Demirci is an associate professor at the Department of Geography, Fatih University in Istanbul, Turkey. He received his Ph.D. degree in 2004 from Marmara University in Turkey and studied secondary school geography education in the USA as his dissertation subject. A part of his dissertation was published in a Turkish book entitled *Education System in the USA with a special focus on Secondary School Geography Education*. His major research interests are geography education in general and GIS and its applications in geography education in particular. He has published many articles in national and international journals in a wide range of topics including curricular developments, the use of GIS and other spatial technologies in geography education, and the application of GIS and remote sensing in different areas. He is the author of the book *GIS for Teachers* published in Turkish with the support of Esri-Turkey in 2008. This book is the only source in Turkey that provides secondary school teachers with sufficient theory and practice on GIS along with digital data, GIS software licensing, and many GIS-based applications to be implemented in geography lessons. He is also co-editor of two books: *Geography,* which is a textbook written for Grade 9 geography lessons and *Methods and Approaches in Geography Education*, which is used as a textbook for a graduate course offered at universities in Turkey. Over the past ten years, he has been involved in a number of activities such as organizing conferences, workshops, and courses to introduce GIS to secondary and higher education institutions in Turkey. He is currently working in a committee in the Ministry of Education to revise the secondary school geography curriculum in Turkey. One of his recent projects is entitled "Using GIS to develop social sensitivity among students: Implementation of GIS-based projects in secondary school geography lessons" supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK).

Joseph J. Kerski serves as education manager on the education team for Environmental Systems Research Institute (Esri) in Colorado, USA. Prior to joining Esri, he served for seventeen years as geographer in the Education Program at the US Geological Survey, and for four years as geographer at the US Census Bureau. He has taught as adjunct instructor of GIS at Sinte Gleska University on the Rosebud Sioux Reservation, at the University of Denver, in primary and secondary schools, and in online courses. Joseph holds three degrees in geography and thus

is rather enthusiastic about studying biomes, population, landforms, hazards, and other topics using technology, maps, and imagery. Passionate about all aspects of spatial learning, Joseph seeks and fosters educational partnerships, promotes GIS in education and society through service and scholarship, and conducts training in geotechnologies for instructors, students, and administrators in a wide variety of educational levels and disciplines, internationally. He creates curricula focused on spatial thinking that uses geotechnologies as its chief inquiry-based tool, and conducts research in the effectiveness and implementation of these technologies in formal and informal educational settings.

Andrew J. Milson is a Professor of social science education and geography with faculty appointments in the College of Education and Health Professions and the College of Liberal Arts at the University of Texas at Arlington, USA. He teaches courses in human geography, GIS, and social studies education. He earned his Ph.D. in 1999 from the University of Georgia (USA), where he studied social science education and geography. Prior to pursuing his doctorate, he taught secondary school history and geography near Dallas, Texas. Andrew conducts research on geographic education and the use of geospatial technologies in educational environments and has published numerous journal articles and book chapters on this work. His co-edited books include *Digital Geography: Geospatial Technologies in the Social Studies Classroom* (Information Age, 2008) with Marsha Alibrandi. He is an elected member of the Executive Board of the National Council for Geographic Education and serves as an associate editor of the *Journal of Geography*.

About the Authors

Svein Andersland is Associate Professor at Stord/Haugesund University College, Department of Teacher Education and Cultural Studies in Norway. He teaches geography, geography didactics, in-service GIS courses, development studies, and other geography-related subjects within the broader social science study in teacher education. His research interests are related to the usage of ICT and GIS in lower education. Currently, he is participating in a national survey within the research program Education, Curriculum and Technology, focusing on teachers' usages and attitudes toward the use of ICT in various school subjects. He has presented and published GIS-related papers in IGU-CGE-held conferences, national and international ESRI user conferences, national geography conferences, and conferences and workshops held by the HERODOT network. He has also written GIS-related chapters in two education-related books

Maria Attard holds the position of lecturer in Geography as well as Director of the Institute for Sustainable Development at the University of Malta. Her specializations are transport geography and GIS. She has coordinated the Geographic Information Systems Laboratory and the teaching of GIS at the university since 1997, mostly at undergraduate but also as part of various postgraduate courses. She has been involved in a number of training programs and the institute will see the development of further GIS study programs at the University of Malta, thus increasing the skills in the available and future workforce. She has published in the areas of transport and GIS education.

Jim Ayorekire is a Lecturer at in the Department of Forestry, Biodiversity and Tourism, College of Agricultural and Environmental Sciences, Makerere University. He attained his doctorate in environmental and geographical sciences from University of Cape Town and holds a master of arts degree in land use and regional development, Makerere University. His teaching and research interests are in regional geography and the application of GIS in land use planning with a bias to tourism planning and management.

György Borián is senior manager of environmental education and ecotourism for the Danube-Drava National Park in Hungary. He has authored or co-authored numerous materials and teachers' manuals for environmental education including five secondary school textbooks.

Gregory Breetzke is a Lecturer of geographical information systems (GIS) at the University of Canterbury, New Zealand. He has been involved in teaching post-graduate GIS programmes in his native South Africa and has now transferred that knowledge to assist in the development of a new master's in GIS programme at the University of Canterbury. His research focuses broadly on geospatial analysis and on different pedagogical approaches to GIS education.

Mohamed R. Bualhamam is a professor in the geography department at the UAE University and head of the Geographical Information Systems committee in the Emirate of Ras al Khaimah. He received his Ph.D. in environmental dynamics and GIS from the University of Arkansas. He is also a chair of authorship and review of the social studies curriculum for Grades 5 and 6 level committees at the Ministry of Education. His research interests include GIS in education, GIS for project management, and environmental applications of GIS.

Theodore Burikoko assists the "GIS in Secondary Schools" project in various activities and serves as instructor for teacher trainings. He has taken part in the project since its early days when he taught GIS to his classmates of the technical school ETO Gitarama. He currently continues his studies of civil engineering at Kicukiro College of Technology in Kigali.

Alfredo del Campo is a geographer engineer at the *Instituto Geográfico Nacional* (National Geography Institute), Madrid, Spain. He is in charge of the *Área de Cartografía Temática y Atlas Nacional* (thematic cartography and national atlas) of the Cartography Section in the General Directorate of the IGN. He studied forest engineering at the Polytechnic University of Madrid (UPM) and completed doctoral studies in the Department of Cartographic Engineering, Geodesy and Photogrammetry: Graphic Expression. He has also obtained the titles of Master of Geographic Information Systems (UPM), Manager of Information Systems and Communications and Information Technologies (UPM) and Senior Public Management at the *Universidad Complutense de Madrid* (UCM). He has taught and worked on speeches and presentations on thematic cartography and the National Atlas of Spain in specialized forums and outreach activities in teaching.

Joan Capdevila directs the regional service of the *Instituto Geográfico Nacional* in Catalonia. He studied physics and geography at the University of Barcelona. He is a member of *Consejo Superior Geográfico* (Geographic High Council) and works on the Committee on spatial data infrastructures and the Committee on Geographical Names. He publishes the blog IDEE, the *Boletín SobreIDEs*, and directs the working groups SDI Observatory and Cartographic Heritage on SDI. In all these fields, he performs tasks related to the diffusion and dissemination of geographic information in education.

Victoria Castro De la Rosa holds a degree in computer science from the *Universidad Autónoma de Santo Domingo* (1998) and a master's in educational technologies from *Pontificia Universidad Católica Madre y Maestra* (PUCMM), Dominican Republic. Currently, she is developing her PhD thesis in Information

and Knowledge Society from the *Universidad Pontificia de Salamanca*, *Madrid* (UPSAM), Madrid, Spain. She works for the Education Ministry in the technology integration department, Dominican Republic. Her research has focused on information technology for education in middle schools in the Dominican Republic.

Chris Charman began his teaching career in 1997 in Waterloo, Ontario. In 2001 he completed his MA in urban/economic geography at Wilfrid Laurier University and became involved in GIS and GPS in the classroom. He found it curious that there was more support for geo-technology from the information technology world than there was from the geographic lobby. This led to questions and research into the difficulties of GIS implementation and the role of geographic education in general. Over the years these questions lead Chris to begin working on a doctorate, focusing on geographic literacy and how students perceive the space around them. In his current role as Geography Department Head in a new secondary school he has sought to build the Geography department with likeminded individuals, who embrace technology while still balancing the need for out of classroom field based experiences for our students.

Che-Ming Chen is Associate Professor of Geography at the National Taiwan Normal University. He has 18 years of experience in geography teacher training at the secondary level. His research and teaching interests include geography education, mobile learning, and spatial information technologies. Che-Ming has approximately 40 scientific publications in peer-reviewed journals, books, proceedings, and other outlets. His current research focuses on mobile learning for high school fieldwork. In the recent 5 years, he held over 60 workshops helping secondary geography teachers to use GPS, GIS, and Google Earth in their classroom.

Natalia Andrea Diaz Vega graduated from the Department of Geodesy and Cadastre Engineering at *Universidad Distrital Francisco José de Caldas* in Bogotá. In 2010, she joined as a professional on the geographic information systems group at the Mobility Secretary Bogotá. Prior to this she worked in a private enterprise company "Ingetec S.A.," managing the geographic information system and developing engineering projects. Also she worked at the Institute for Urban Development of Bogotá on feasibility projects for valorization. She is a member of the students research group SDI (Spatial Data Infrastructure) and has won an award for the project regarding a GIS application for teaching geography in basic secondary education in Colombia. Currently, she is doing her postgraduate studies in local development and environment at the *Universidad Distrital Francisco José de Caldas*.

Pinliang Dong is an Associate Professor at the Department of Geography, University of North Texas, Denton, Texas, USA. He has been doing research and teaching in areas of geographic information systems and remote sensing. His research interests include spatial analysis and modeling, GIS application development for emergency response and animal tracking, GIS and remote sensing for land cover mapping, biomass estimation, and population estimation. He has taught

Introduction to GIS, Intermediate GIS, Advanced GIS, GIS Programming, Remote Sensing, and Special Topics. He has published over 20 journal papers and book chapters.

Stephanie A. Eddy is the Director GISMAPED. She served as Head of Social Sciences at Botany Downs Secondary College in New Zealand from 2003 to 2006, Deputy Principal of Botany Downs Secondary College in 2005, and Head of Geography Macleans College, New Zealand from 2000 to 2003. In 2000, she introduced GIS into the Social Sciences Department at Macleans College, and in 2001 was the recipient of the Macleans College staff scholarship that allowed her to visit schools in the USA. She has attended numerous international workshops and training sessions on GIS in education and was recently awarded the Royal Society of New Zealand Teacher Fellowship to study GIS in New Zealand secondary schools.

Sanet Eksteen is GIS lecturer in the Department of Geography, Geoinformatics and Meteorology, at the University of Pretoria, South Africa. She teaches courses in introductory and advanced GIS, and her research focuses on the introduction of GIS in secondary school as well as the use of artificial intelligence in GIS. She was involved in the development of a Paper GIS to enable schools to teach GIS without the use of computers.

Mary Fargher is a Lecturer in Geography Education at the Institute of Education (IoE), University of London. After over twenty years working in schools as a geography teacher and subject leader, she was awarded an ESRC studentship to study for her PhD at IoE in 2005. Since then, she has taken part in a number of research projects using GIS with teachers and students in schools (including the Geographical Association's 'Spatially Speaking' project) and is regularly involved in geography education and GIS conferences (including ESRI). Mary is currently writing up her PhD thesis on place and GIS.

Tim Favier is a PhD student at the Free University Amsterdam. His research focuses on how geography teachers can use GIS to stimulate progression in students' geographic literacy. In his research, he has developed several successful GIS-supported inquiry-based geography modules with teachers from different schools. Tim Favier also works in the EduGIS project, which aims to stimulate the diffusion of GIS in secondary education in The Netherlands.

Martina Forster is the project coordinator for "GIS in Secondary Schools" at the GIS and RS Centre of the National University of Rwanda (CGIS-NUR). The program is designed to promote GIS integration through all levels of secondary education in Rwanda and inter-institutional collaboration in the field of GIS for Development.

Sylvain Genevois works at the National Institute for Educational Research (INRP), Lyon, France. His PhD work in geography and science education examines the questions posed by the introduction of geomatic tools in French secondary schools. His research interests also concern localized games and augmented reality.

Iain Greensmith has been with ESRI Canada since September of 2007 in the capacity of Technical Solutions Specialist, Education. Iain is able to draw from his technical experience in previous roles as well as his 12 years of coaching experience to ensure that educators benefit from the training and resource development, and direction he provides. Iain is a graduate of McMaster University with a degree in geography that specialized in GIS and spatial analysis, and is a current M.Sc. GISc candidate through Birkbeck College, University of London.

Niem Tu Huynh joined the Association of American Geographers (AAG) staff as Senior Researcher in June 2011. Prior to joining AAG, Niem taught secondary level science in Canada and was an Assistant Professor in the Department of Geography at Texas State University – San Marcos. Her research interest is how spatial thinking and geographic skills influence problem solving with geospatial technologies, particularly with GIS. This interest stems from her dissertation, which was completed in Fall 2009 at Wilfrid Laurier University.

Yoshiyasu Ida is a professor at Graduate School of Comprehensive Human Sciences (Institute of Education), University of Tsukuba. He is the Chair of Education Sciences and School Education in Graduate School, University of Tsukuba. He obtained his Ph.D. from the University of Tsukuba. He is interested in curricula in every county and GIS education in secondary school. He has published articles on GIS, geography, and environmental education in journals such as *Tsukuba Journal of Educational Studies* and *Geographiedidaktische Forschungen*. He is also the author of *Social Studies Education and Region*.

Thomas Jekel is senior scientist at the Institute of GIScience, Austrian Academy of Sciences, Salzburg, Austria. He is currently responsible for research and education projects for GI use in secondary schools. He studied geography and communication science at the University of Salzburg for MSc and PhD.

Torben P. Jensen is a Teacher of Geography and History at Langkaer Gymnasium and HF, Aarhus, Denmark. He earned his M.Sc. in Geography and History from the University of Aarhus, Denmark. He is the former Chairman of the Danish Association of Upper-Secondary Teachers of Geography and former President of the European Association of Geography Teachers' Associations. He is co-author and co-editor of *Geografi: Natur - Kultur - Menneske*, Geografforlaget 1992. Geography: Nature–Culture–Man and *GO, Naturgeografi, Jorden og mennesket*, Geografforlaget 2006 (GO, Geoscience, Earth, and Man); both widely used upper-secondary Geography course books. He is also co-author and co-editor of *Bæredygtig energi, Natur og Viden*, Geografforlaget 2010 (Sustainable Energy), an interdisciplinary basic introductory upper-secondary science course on sustainable energy including biology, chemistry, geography, and physics.

Tino P. Johansson received his Ph.D. from the University of Helsinki in Finland in 2009. He works as a research coordinator at the Department of Geosciences and Geography and has specialized in educational use of Geographical Information Systems. He has organized several pre- and in-service teacher courses on the educational use of GIS in Finland. He has been actively involved in national and European

projects that have introduced GIS into schools and developed ways to integrate these interdisciplinary teaching and learning tools into the daily activities of teachers and pupils. He is currently coordinating the Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa (CHIESA) Project in Nairobi, Kenya.

Thierry Joliveau is professor of geography and geomatics at Jean Monnet University of Saint-Etienne (France) where he is in charge of the Master "GIS and Space Management" program. He is member of the CNRS research laboratory EVS (*Environnement, Ville, Société*) and director of the CNRS collaborative research network MAGIS (Models and Applications of Geographical Information Science). His research interests include several topics relating to the use of geographical information in society, education, environmental management, and landscape planning.

Minsung Kim is a Ph.D. candidate in the Department of Geography at Texas A&M University in College Station, Texas, USA. His primary research interests include spatial literacy, geo-spatial technologies, and spatial concept development. He received his master's degree in geography education from Seoul National University in South Korea and was involved in projects developing geography education materials.

John C. Kinniburgh is the Head of Geography at The King's School, a comprehensive independent boarding school in Sydney, Australia. Having taught at the school for the past thirteen years, John first introduced students to Geographic Information Systems (GIS) in 1998 and since then has integrated GIS into the Geography curriculum from years 7 to 12. He is a leader in the use and application of GIS in geographical education and a key advocate for its role in fostering authentic learning environments for boys. He has conducted numerous workshops on the use and application of GIS in the Geography classroom and has spoken at a number of conferences including the ESRI International Education User Conference in San Diego in 2003. He is currently completing a PhD at Macquarie University by investigating how, and to what extent, GIS enhances the conceptual understanding of geography students in New South Wales. His current research investigates the way in which GIS supports constructivist learning environments, particularly those that adopt instructional frameworks that incorporate problem-based learning (PBL).

Arne Frank Knudsen is a senior high school teacher in geography, history, and Norwegian language. He teaches geography, geoscience, and Norwegian language in Laksevåg Upper Secondary School. From 1984 to 2006 he taught geography didactics at the Department of Teaching Education, University of Bergen. He has been a practice teacher at the same place since 1984. For several years, he has had a special interest in teaching geography and has participated in a pilot project "GIS in Schools," initiated by and under the leadership of Svein Andersland.

Alfons Koller is a high school teacher at the Petrinum High School, Linz, Austria. He coordinates geography and economics within the Austrian Innovations in Mathematics and Science Teaching (IMST) program. He is also involved with several EU projects aiming at the inclusion of GI in teacher training and comanages the

annual Learning with GI conference at Salzburg. He studied geography and mathematics at the University of Salzburg and has been active in vocational training of geography teachers since the early 1990s.

María Luisa de Lázaro is an Associated Professor of Human Geography at the *Universidad Complutense de Madrid* (UCM), Spain. She has been member of the board of the *Real Sociedad Geográfica* of Spain since 1992 and President of the Spanish work group in geography didactics (*Didáctica de la Geografía, Asociación de Geógrafos Españoles*) since November 2008. She has published GIS-related papers in the journal "*Didáctica Geográfica*" (Focus on Teaching Geography - for which she has been editorial secretary since 2010), for the meetings of HERODOT, EUROGEO, and several congresses. Her research interests are GIS and ICT for learning, researching and teaching geography in higher education and sustainability development in cities and in the Spanish countryside.

Sang-Il Lee is an associate professor in the Department of Geography Education at Seoul National University. He received his Ph.D. degree from Ohio State University. His research interests include GIS, spatial data analysis, and cartography. He has been responsible for running a branch of the National GIS Education Center in South Korea. He has also been involved in various teacher retraining programs with special focus on GIS for K-12 geography education.

Peiying Lin is a Professor at the Department of Geography, College of Resources, Environment and Tourism, Capital Normal University, Beijing, China. She has been teaching undergraduate and graduate courses in Geography Pedagogy, Geography Education, Computer Aided Geography Teaching, Modern Teaching Technologies in Geography, Environment Education, and English for Geography Majors. She has worked as Principal Investigator for six research projects on information technology for geography education in Chinese secondary schools. She has also edited and co-edited 10 books, and published 27 papers.

Yan Liu is Senior Lecturer in Geographical Information Sciences at the School of Geography, Planning and Environmental Management of the University of Queensland, Australia. Her research interests include GIS applications, spatial analysis and modeling, as well as learning with GIS in schools. She was an Assistant Professor at the National Institute of Education, Nanyang Technological University in Singapore when she conducted this research project. She is a member of the Surveying and Spatial Sciences Institute in Australia.

Gustavo Moreira-Riveros earned the master's in education from Universidad de Chile and public administration from the same higher education institution in Chile. He is a full-time professional working for the Ministry of Education, Santiago, Chile. His responsibilities are focused on information and communication technologies (ICT). As a specialist in public administration he coordinates activities related to the electronic government and the design and development of GIS for regional development in Chile. GIS development in school environments is his main focus of research. He has attended and participated in four ESRI International Conferences.

GIS applied to territorial information system for education and teaching with GIS in K–12 have been his main topics of applied research.

Madalena Mota is a geography teacher, teaching middle school and high school in Portugal since 1994. She has a M.Sc. degree in "Science and GIS" (2005) from the *Instituto Superior de Estatística e Gestão de Informação*, New University of Lisbon (ISEGI-UNL). Since 2004, she has used GIS in her classrooms and is involved in organizing events like GIS-Days with students. She also worked as the pedagogical coordinator of the ConTIG project at ISEGI-UNL, during a sabbatical year from teaching, in 2008–2009.

Osvaldo Muñiz-Solari, earned his Ph.D. in Geography from the University of Tennessee, Knoxville, and MA in Geography from Michigan State University, East Lansing. He is an associate professor in the Department of Geography and Associate Director of the Gilbert M. Grosvenor Center for Geographic Education at Texas State University. His initial academic preparation was in Pedagogy in Geography, History, and Civic Education at the University of the North, Antofagasta, Chile. As a geographer, he held academic positions in several universities and developed private consultant work in Argentina, Brazil, Colombia, Ecuador, Peru, and Chile. His specialties in geography education are focused on new technologies for international collaboration, one of which is GIS applications. Online learning methods and scientific diffusion through electronic networking are also important specialties that concentrate his publications. He is a member of the Steering Committee for the International Geographical Union's Commission on Geographical Education representing countries in Latin America.

José Antonio Nieto is a technician at the Institute of Cartography of Andalusia in Seville, Spain. He coordinates the department working on the elaboration of didactic and educative material related to cartography and geographic knowledge. He is also responsible for Didact-ICA, which is the section of the Web page of the Institute of Cartography of Andalusia that incorporates didactic material and links. He is member of the Group of Didactics of the Association of Spanish Geographers and is doing research on the geography of the population.

Albert Nsengiyumva serves as the Coordinator ICT in Education and also coordinates the establishment of the Rwanda Education and Research Network (RwEdNet) that aims at providing affordable Internet connectivity to tertiary education in Rwanda. He is also a network partner of the Research ICT Africa Network (RIA!) and the Deputy Chair of Ubuntunet Alliance for Research and Networking in the Eastern and Southern African region. He is a multidisciplinary professional with more than 12 years of experience. He is a former director of the National University of Rwanda Computing Center and has worked in computer networking projects as well as in the area of ICT research particularly in policy and regulation.

Benjamin Ofori-Amoah is a Professor of Geography and Chair of the Department of Geography at Western Michigan University, Kalamazoo, Michigan, USA. He holds a PhD degree from Simon Fraser University, Canada (1990), an MA (higher

education administration) from the University of Exeter, UK (1984), an MSc (planning) degree from the University of Science and Technology, Kumasi, Ghana (1980), and a BA (geography with statistics) degree from the University of Ghana (1977). Prior to entering the university Ben taught as an elementary school teacher, from 1972 to 1977 in his native Ghana, after completing a four-year teacher training program. After obtaining his baccalaureate degree, he went back to teach geography at high school from 1977 to 1979. From 1980 to 1983, he worked as assistant registrar at the Kwame Nkrumah University of Science and Technology, in Kumasi, Ghana. In 1983, he left Ghana for further studies in the UK and Canada and eventually arrived in the USA in 1991, when he received appointment as Assistant Professor of Geography at the University of Wisconsin-Stevens Point. In 1999, Ben served as the Administrative Associate to Dr. David J. Ward, the then Senior Vice President for Academic Affairs of the University of Wisconsin System. He was the Chair of the Department of Geography and Geology at Stevens Point from 2001 to 2006, before he moved to Western Michigan University in 2006. Ben is an economic geographer and a regional planner with expertise in economic development, location analysis, urban and regional planning, and geographic information systems (GIS), and research interests in development theory, development planning, technological change, and human factor development. He has given scholarly presentations at many professional conferences and published in these areas of expertise. His most recent publication is an edited volume titled *Beyond the Metropolis: Urban Geography as if Small Cities Mattered.* University Press of America Lanham, MD: University Press of America, 2006.

Anne F. Olsen is the head of social sciences at Chilton Saint James School in New Zealand and director of GISMAPED. She has attended numerous international workshops and training sessions on GIS in education. In 1999, she introduced GIS into the Social Sciences Department at Chilton Saint James School. In 2001, she received a Royal Society of New Zealand Teacher Fellowship to study "The integration of GIS into Secondary School Geography" and visited schools in the USA, Canada, and Australia to observe the use of GIS. In 2002, she established GISMAPED with Stephanie Eddy to promote GIS in schools by providing training and resources. Recently, she served as the lead author on New Zealand GIS lessons.

Joseph R. Oppong is a Professor of Geography and Associate Dean of Toulouse Graduate School at the University of North Texas, Denton, Texas, where he has been teaching since 1992. He has a BA in geography from the University of Ghana and MA and PhD degrees from the University of Alberta, Edmonton, Canada. Prior to coming to UNT, Dr. Oppong taught at the University of Iowa. He currently serves as the US representative to the International Geographers Union Commission on Health and Environment and has served as chair to the Medical Geography Specialty Group and also the Africa Specialty Group of the Association of American Geographers. Dr. Oppong's research centers on medical geography, particularly the application of spatial analysis and GIS techniques to health care issues in Africa and Texas. Dr. Oppong has published articles on HIV/AIDS in Africa, teen HIV/AIDS in Dallas County, and Tuberculosis Genotypes in Tarrant County, Texas.

He coedited the volume *HIV-AIDS in Africa: Beyond Epidemiology* (Blackwell Publishers) and a special issue in Social Science and Medicine titled *HIV/AIDS, gender, agency and empowerment issues in Africa*. His latest research focuses on computational epidemiology, mapping tuberculosis genotypes, and racial/ethnic disparities in tuberculosis and HIV/AIDS in Texas and Africa. As associate dean of Toulouse Graduate School, Dr. Oppong is responsible for UNT's Responsible Conduct of Research policy formulation and implementation.

Quinta Ana Pérez Sierra earned a degree in computer science (2000) and a master's degree in telecommunication (2003) from the *Universidad Autónoma de Santo Domingo* (UASD), Dominican Republic. She also holds a Master's degree in Geographical Information Systems (GIS) and is currently developing her PhD thesis in GIS from the *Universidad Pontificia de Salamanca*, *Madrid* (UPSAM), Madrid, Spain. Her research has focused on (1) GIS technology for disasters management focused on crisis mapping, (2) GIS for the prevention of flood disasters with particular emphasis on simulation of hydrological processes, and (3) GIS technology for education. Currently, she is research professor for *Instituto Tecnológico de Las Américas* (ITLA), TI Professor for the *Universidad Iberoamericana* (UNIBE), and founder and director of the Geographic Information Systems School in the Dominican Republic.

Erika Pretorius is Technical Assistant at the Department of Geography, Geoinformatics and Meteorology, at the University of Pretoria, South Africa. She was previously an educator and a part-time contributor to the online Earthwire News Portal. Her research interests include an integrated approach to teaching geography with GIS as well as the use of GIS in developing suitability indices for the positioning of Fog Water Collection Systems.

David Rayner is a Lecturer in Geography Education at the Institute of Education (IoE), University of London. After thirty years working in schools as a geography teacher and subject leader, he took on the role of National Subject Lead (NSL) for KS3 Geography, leading a team of 25 teachers and advisors in supporting the government roll-out of the New Secondary Curriculum in England. David has a long-standing interest in GIS and technology in education. He was involved in one of the first UK local authority GIS initiatives in 2002 and wrote the online GIS teacher guidance for the Royal Geographical Society website. Alongside his work at the IoE, David continues his role as NSL running GIS workshops and conferences to support teachers wishing to embed GIS into the secondary curriculum.

Luz Angela Rocha Salamanca graduated from the Department of Geodesy and Cadastre Engineering at *Universidad Distrital Francisco José de Caldas* in Bogotá and received her Msc degree in geoinformation systems from ITC, The Netherlands, in 1997. She worked for almost nine years at the National Geographic Institute of Colombia "Agustin Codazzi" at the Cartography Department, where she gained a lot of experience in map production. In 2001, she joined the Universidad Distrital at the Faculty of Engineering, Cadastral and Geodesy program, as an assistant professor teaching cartography and geographic information systems. Currently she

is a researcher of the research group NIDE (Research Nucleus in Spatial Data). She is also a team director of the students research group SDI (Spatial Data Infrastructure) and belongs to the editorial committee of the scientific journal "*UD y la Geomatica*." Presently, she is continuing her PhD studies at the Universidad Nacional of Colombia in the Department of Geography.

Jan Ketil Rød is Associated Professor in Geographical Information System and Science at Department of Geography, Norwegian University of Science and Technology. He teaches statistics, cartography, GIS, and remote sensing. His research is on applications of GIS in urban planning, studies of civil armed conflicts, vulnerability to environmental hazards, and the implementation of GIS in upper secondary schools. He has published in *Environmental Planning B: Planning and Design, Political Geography, Journal of Conflict Resolution, International Studies Quarterly, International Organization, Conflict Management and Peace Science, Norwegian Journal of Geography,* and *Cartographica and Cartographic Perspectives.*

Concepción Romera is a geographer engineer at the *Instituto Geográfico Nacional*, Madrid, Spain. She is in charge of the CARTOSOPHIA Project and leads the Web page "*Cartografía para la enseñanza*" (Cartography for teaching). She deals with the management of knowledge and with training in thematic cartography. She is the vice president of cartography in the *Sociedad Española de Cartografía, Fotogrametría y Teledetección* (Spanish Society of Cartography, Photogrammetry and Remote Sensing).

Eric Sanchez is professor at the faculty of education of the University of Sherbrooke, QC (Canada), and assistant professor at *École Normale Supérieur de Lyon* (France). His research work concerns the uses of information and communication technology for educational purposes (elearning, simulation, serious games).

John A. Schembri is a senior lecturer in Geography at the Mediterranean Institute of the University of Malta. He has a B.A. from the University of Malta in contemporary Mediterranean studies and history and later obtained an M.A. in the geography of the Middle East and the Mediterranean and a Ph.D., both from Durham University, UK. He is a fellow of the Royal Geographical Society. John is coordinator of the geography division at the Institute and lectures mainly in human geography. His main research interests and publications are in populations of walled towns, development in ports and harbors, and historical heritage along urban coastal areas. John is a regular contributor to courses organized by the International Ocean Institute in Malta and is involved in the local national geography examinations, the development of syllabi in geography for ordinary, intermediate, and advanced levels and has been involved in the development of geography at the university.

Henk J. Scholten studied mathematics and geography at the Vrije Universiteit Amsterdam and obtained his PhD in 1988. Since 1990 he is professor in spatial

informatics at the Faculty of Economics of the Vrije Universiteit Amsterdam and Director of the Spinlab (www.spinlab.vu.nl).
Prof. Scholten is founder and CEO of Geodan, one of the largest European companies specialized in Geospatial Information Technology (www.geodan.nl). Prof. Scholten is advisor for the European Union and several ministries in the field of disaster management and GIS. He has written more than 100 articles and 9 books on GIS. In July 2009, the 'Lifetime Achievement Award' was given to Prof. Scholten by Jack Dangermond, founder of ESRI. This award is given to a person who has contributed significantly to advancing the science and technology of GIS throughout his career.

Bob Sharpe is an Associate Professor and Associate Dean of Arts (Academic Development) at Wilfrid Laurier University in Waterloo, Ontario. His primary teaching and research interests are at the intersection of human geography and geomatics. He has taught and supervised students for twenty years at both the undergraduate and graduate levels in the fields of urban and economic geography, geographic information systems, cartography, and geographic education. Whenever possible, he incorporates fieldwork and geotechnologies into student learning experiences. Among Bob's research interests are issues of change and conflict in the city, and the application of geotechnologies to geographic education.

Alexander Siegmund currently is a full professor and head of the Department of Geography at the University of Education Heidelberg, as well as an honorary professor at the Institute for Geography at the University of Heidelberg. He has set up the "Klaus-Tschira-Competency Center for Digital Geomedia in Schools" and leads the Research Group for Earth Observation (rgeo), which focuses on research in geography and geography didactics, the development of learning environments using geospatial technology and in- and pre-service teacher training. His PhD, completed in 1997, focused on the regional climate of the Baar region in Germany. He studied geography, economics, and education at the University of Mannheim and was a teacher at a trading school for several years. He also held a professor position at the University of Education in Karlsruhe (Germany), a researcher position at the University of Mannheim as well as lecturer positions at the University of Karlsruhe, the University of Applied Science Karlsruhe, and the University of Heidelberg.

Hans-Jörg Stark is a professor at University of Applied Sciences Northwestern Switzerland, School of Architecture, Civil Engineering and Geomatics, Institute of Geomatics Engineering. He has been teaching geographic information systems and science since 2004. Before that he had worked for more than twelve years in the GIS industry, mainly as GIS project manager and in the development of GIS applications. His research interests are in the field of Volunteered Geographic Information (VGI), collaborative mapping, Open Source GIS, and Geo-Marketing. Besides the initiation of the "Map your World" project for secondary level students, he is also the founder of the VGI Project OpenAddresses.org. Currently he is involved in many national research projects in the aforementioned fields.

Josef Strobl is head of the center for geoinformatics at the University of Salzburg, Austria. He studied geography, meteorology, and geology with an MSc and PhD

in Geography from the University of Vienna, Austria. Since 1985, he has taught and conducted research in computer-assisted cartography, remote sensing, statistical methods, and geographical information systems at the University of Salzburg.

Geok Chin Ivy Tan is an Associate Professor of Humanities and Social Studies Education Academic Group and Sub-Dean, Diploma and Practicum, Office of Teacher Education at the National Institute of Education, Nanyang Technological University, Singapore. She has taught as a geography teacher and has been Head of the Humanities Department in secondary schools. She has also been a Gifted Educational Specialist (Geography) in the Ministry of Education, Singapore. Presently she is a Commission Member of the International Geographical Union – Commission on Geographical Education and also serves as a regional representative of the International Association for the Study of Cooperation in Education. She is an executive member of the South East Asian Geography Association and the Geography Teachers' Association, Singapore.

Vinod Tewari is chair professor for National Capital Region Studies at TERI University, New Delhi. He has more than four decades of national and international experience working on various spheres of urban development planning, management, and governance. His specific research, consultancy, and teaching interests are in the areas of urban policy, urban institutional reforms, urban infrastructure management and financing, and urban poverty alleviation. He has taught courses in postgraduate- and PhD-level teaching programs and short-term training programs related to urban policy, urban management, quantitative urban modelling, public policy, geographic information systems, and research methodology. He has published a number of books/reports (with publishers such as Johns Hopkins University Press, Concept publishers, Allied publishers, and World Bank) and a number of research papers on topics related to his areas of interest in refereed journals including *Regional Development Dialogue*, *International Regional Science Review*, *Environment & Planning B: Planning & Design*, *IIMB Management Review*, *Geographical Review of India*, *Problems de Croissance Urbaine dans le Monde Tropical*, *CEGET*, *Sankhya*, and *Analytical Geography*, and in the reports of the National Commission on Urbanisation, Government of India, World Bank, Washington, and UNCRD, Nagoya. For his pioneering work in the area of GIS and service planning in India during the 1980s, he received Geodyssey Award of Geodyssey Environmental GIS Research Initiative instituted by Autodesk Inc., California, USA, and Environmental Systems Research Institute (ESRI), Inc., Redlands, California, USA in March 1993.

Chetan Tiwari received his PhD in geography from The University of Iowa in 2008. He is currently an assistant professor of geography at the University of North Texas in Denton, Texas. He is also affiliated with the Center for Computational Epidemiology and Response Analysis (CeCERA) at UNT. His research interests are in the applications of Geographic Information Science and spatial analysis methods for problems in public health. Specifically, he is interested in using GIS for mapping disease burdens and for environmental health surveillance. He has previously

collaborated with several health departments across the USA and the National Cancer Institute. He is also the primary developer for an open-source disease mapping framework called WebDMAP. He currently teaches GIS, medical geography, location modelling, and human geography courses to undergraduate and graduate students at the University of North Texas and the University of North Texas Health Science Center.

Jean Tong has been with ESRI Canada since May 2007 in the Education Industry Manager's role. Prior to this, she taught Grades 7–10 Social Sciences in Toronto. Her primary role at ESRI Canada is to introduce educators and administrators to Geographic Information Systems (GIS) by demonstrating how GIS can be used both in the classroom and for campus management in areas such as bus routing and planning. She is actively involved in presenting to educators and conducting training about the use of GIS in education. In addition, she is responsible for many other aspects of the education program such as creating resources and working with museums. Jean is a graduate of Canterbury University and McMaster University with degrees in Education and Geography.

Carmen Treuthardt studied geography at the University of Zurich. Since 1998 she has taught geography and political education at the Lucerne High school. She is co-author of the GIS book *Geografische Informations Systeme*, which will be used often in upper secondary education and is the first Swiss GIS training book for Grades 7–12 in German. This book was honored with "Special Achievement in GIS Award" at the Esri International User Conference 2007. Carmen Treuthardt is also the president of the Association of Swiss Geography Teachers (VSGG).

Revocatus Twinomuhangi is a Lecturer in the Department of Geography, Informatics and Climatic Sciences, College of Agricultural and Environmental Sciences, Makerere University. He received his doctorate from Makerere University. His current research interests are in GIS Applications in waste management, natural resources management, and climate change adaptation and mitigation.

Joop van der Schee is professor for geography education at the Center for Educational Training, Assessment and Research at VU University Amsterdam, The Netherlands. He teaches human geography, geography didactics, and in-service courses, and is coach for research projects of master students and a group of geography education PhD students. His research interests are related to the use of maps and GIS and thinking skills in geography education. He has written scientific articles as well as books for teachers about geography in education, thinking skills, and the use of digital maps. He is co-chair of the International Geography Olympiad and member of the IGU Commission on Geographical Education.

Kathrin Viehrig currently is a researcher at the Department of Geography at the University of Education Heidelberg in Germany. Her PhD research focuses on the effects of GIS use in secondary schools on student achievement in geography, particularly with regard to systemic and spatial thinking. She also works within the research project "HEIGIS", which in its first phase aims at developing

a geographically, didactically, and psychometrically sound assessment instrument for geographic system competency. Kathrin graduated with a first state exam for teachers, an M.A. in European Bilingual Education and an additional qualification for intercultural education/ foreigner pedagogy from the University of Education in Karlsruhe, Germany. She has studied for a semester at the University of Auckland, New Zealand.

Xi Xiang is a doctoral student at the National Institute of Education, Nanyang Technological University, Singapore. Her research interests include using geospatial technologies to develop spatial thinking of students, and designing teaching and learning resources for geography learning.

Rawan Yaghi has been a teacher for 16 years and is now the coordinator of English language and extracurricular activities in Nabil Adeeb Sleiman Secondary Public School in Bednayel-North Bekaa, Lebanon. She is also the educational director of the nationwide project, Teach Women English (TWE). She is a teacher trainer with the British Council in a project funded by HSBC and in a partnership with the Ministry of Education.

Minori Yuda is an assistant professor at the Center for Spatial Information Science, the University of Tokyo. She obtained her Ph.D. in utilization of GIS in school education from Kanazawa University. Her research interests are utilization of GIS in school education in Japan and other countries, and development of applications and courses using GIS and WebGIS in school education. She has published articles on GIS in education in Japan and Finland.

Chapter 1
The World at Their Fingertips: A New Age for Spatial Thinking

Andrew J. Milson, Joseph J. Kerski, and Ali Demirci

1.1 Introduction

As the first decade of the twenty-first century comes to a close, it is clear that young people around the world have opportunities to learn in ways that are quite different from those of their parents and grandparents. The *New York Times* columnist Thomas Friedman has famously described this technologically interconnected world as flat (Friedman, 2005). Yet, geographer Harm de Blij cautions us to pay close attention to the differences that exist between places despite the forces of globalization (de Blij, 2008). Both authors, along with many others, have captured the numerous ways in which the Internet and personal computers have altered the acquisition and diffusion of information, along with patterns of commerce and culture. New terms have been coined in an attempt to describe this altered landscape. Young people who were born since the rise of personal computers, the Internet, and handheld digital devices are referred to as the "net generation" (Tapscott, 1998) or "digital natives" (e.g., Palfrey & Gasser, 2008), while the gap between the technological haves and the technological have-nots is summed up as the "digital divide" (e.g., Norris, 2001). One important question that has arisen for educators and citizens around the world is, "How do we effectively educate digital natives, while also working to narrow or eliminate the digital divide, in an era of globalization?" Any attempt to respond to that question requires an acknowledgment of the spatial relationships at play. "Where?" and "Why there?" become fundamental questions for understanding the twenty-first century world. These questions are the essence of the study of geography, and the importance of these questions in the twenty-first century has brought renewed attention to the geographer's primary tool: the map.

Maps have always been the most powerful tool in human history for understanding, analyzing, and managing the physical and human characteristics of the Earth's surface. Early maps drawn on paper were primarily used to locate features such as rivers, resources, roads, and settlements across the world. These maps helped

A.J. Milson (✉)
University of Texas at Arlington, Arlington, TX, USA
e-mail: milson@uta.edu

A.J. Milson et al. (eds.), *International Perspectives on Teaching and Learning with GIS in Secondary Schools*, DOI 10.1007/978-94-007-2120-3_1,