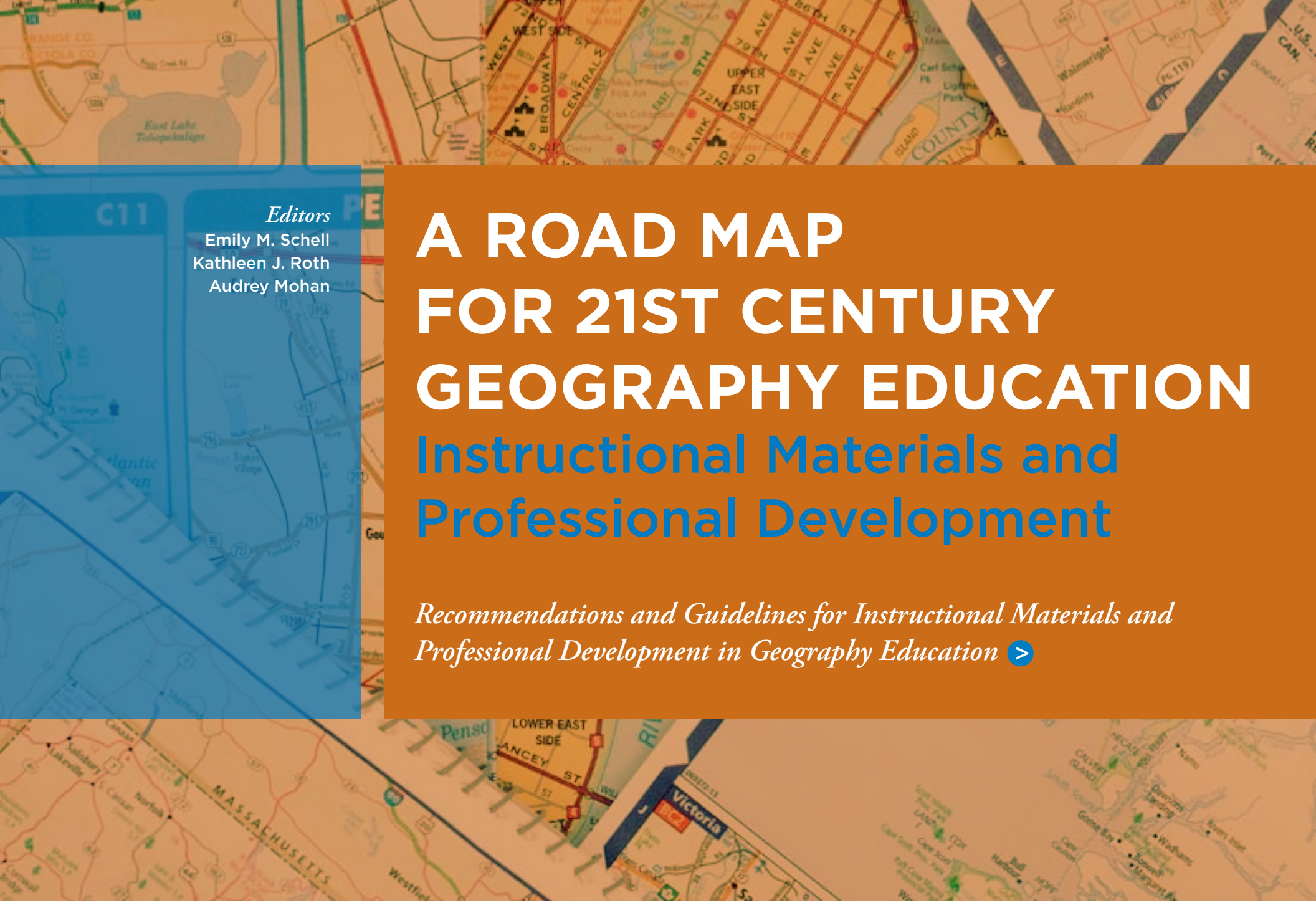

Editors
Emily M. Schell
Kathleen J. Roth
Audrey Mohan

A ROAD MAP FOR 21ST CENTURY GEOGRAPHY EDUCATION

Instructional Materials and Professional Development

Recommendations and Guidelines for Instructional Materials and Professional Development in Geography Education >

A Report from the Committee on Instructional Materials and Professional Development of the Road Map for 21st Century Geography Education Project

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National Council for Geographic Education
Washington, DC

A Report from the Committee on Instructional Materials and Professional Development of the Road Map for 21st Century Geography Education Project

This report was created by the Road Map for 21st Century Geography Education Project.

Road Map for 21st Century Geography Education Project

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The Road Map for 21st Century Geography Education Project is a collaboration between the National Geographic Society, the Association of American Geographers, the National Council for Geographic Education, and the American Geographical Society. The views expressed in the report are those of the authors and do not necessarily reflect the views of these organizations.

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The **Association of American Geographers** (AAG) is a nonprofit scientific, research, and educational society founded in 1904. Its 11,000 members from more than 60 countries share interests in the theory, methods, and practice of geography (including GIScience, geographic education, and geographic technologies). The AAG pursues its mission through its many conferences, scholarly publications, research projects, educational programs, topical specialty groups, and its extensive international network of colleagues and organizational partnerships, which encompass professionals working across public, private, and academic sectors all around the world.

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Table of Contents

Executive Summary 7

Preface 12

Chapter 1: Context and Goals for the Road Map for 21st Century Geography Education Project 19

- The State of Geography Education in the United States
- The Importance of Geography Education
- The Need for a "Road Map" for Geography Education
- Establishing a Destination: Goals for K–12 Geography Education
- Describing the Destination: Effectiveness and Balance
- Mapping a Bright Future
- A Road Map for this Report

Chapter 2: A Vision of Teaching and Learning in Geography 30

Chapter 3: Recommendations and Guidelines 35

- Recommendation 1: Big Ideas and Practices of Geography 38
- Recommendation 2: Student Thinking and Experience 47
- Recommendation 3: Engaging Classrooms 59
- Recommendation 4: Educative Curriculum 70
- Recommendation 5: Teacher Knowledge 76
- Recommendation 6: Vision for Professional Development 84
- Recommendation 7: Preservice Teacher Education 91
- Recommendation 8: Call for Research and Evaluation 98
- Recommendation 9: Need for Collaboration 103
- Recommendation 10: Development of Tools 107

Chapter 4: Quick Reference Tables 115

Chapter 5: Taking Action: Summary and Next Steps 123

Appendix A: Glossary 127

Appendix B: Committee Biographies 129

References 132

In the online version of this report, the icon on the lower left corner of the following pages will bring you back to this Table of Contents.

Executive Summary

Never before in human history has it been more important for a person to be geographically literate. Our world is astoundingly complex and increasingly interdependent—economically, environmentally, politically, socially, and culturally. But the unsettling reality is that many teachers and most students are not yet geographically literate. Currently, American students are not even provided opportunities to learn enough geography to understand the very basic aspects of the world in which they live. Without explicit intervention and a dedicated focus on geographic literacy by educators, curriculum developers, and policy makers, U.S. children will be unable to thrive in the global marketplace, unlikely to connect with and care for their natural environment, and unsure about how to relate to people from other parts of the world. One thing is abundantly clear; if American children hope to participate in our democracy and play a strong leadership role in our world, they must possess geographic knowledge, skills, and perspectives. Simply put, if our children are not taught to think geographically, their success and the success of our nation and world in the 21st century are in jeopardy.

This statement emerged from a highly motivated group firmly committed to the goals, importance, and teaching of geographic literacy. The Instructional Materials and Professional Development Committee of the Road Map Project convened to identify the needs for geography education in the 21st century. These needs span every grade level in our nation's formal and informal education systems in public and private education. These needs extend beyond the stand-alone geography course, and they exist in science, technology, mathematics, social studies, arts, and English language arts courses as well. These needs can and should be addressed through carefully designed and properly implemented instructional materials and professional development.

When the needs for geography education are met, this Committee envisions teachers and students actively engaged in generating questions, exploring solutions, and making decisions about personal, local, national, and global issues. We envision learning experiences that captivate students' attention, develop their inquiry and thinking skills, and increase their understandings of the physical and cultural aspects of place. All the while, students are effectively using geospatial technologies—in and out of the classroom—in meaningful ways to access, evaluate, analyze, produce, and share information. These learning experiences also should inspire and support teachers who share their ideas, challenges, student work, and resources in professional learning communities. This vision requires serious attention to two interrelated features of education: the materials developed and adopted for use in classrooms as well as the professional development provided for teachers who will transform this vision to reality.

Recommendations

The goal of this Committee was to create research-based recommendations and guidelines to support: the key knowledge, practices, and dispositions that students and educators must possess; strategies for supporting the professional development of educators; and the design and evaluation of engaging and effective instructional materials in geography. Therefore, this report provides 10 important recommendations for educators, developers, policy makers, and funders to seriously consider in supporting student learning, teacher learning, and large-scale collaboration and change in the field of geography education through instructional materials and professional development. Summarized below, each recommendation is presented in the full report with a core argument and supporting research, vignettes of each recommendation in practice, examples of alignment to other standards, additional information about recommended strategies or principles, and recommended readings.

To support student learning in geography...

Recommendation 1: Focus instructional materials on big ideas and practices of contemporary geography across subjects and grade levels.

Instructional materials support teachers in making important decisions about what to teach and how to teach it. Most of these teachers are not geographers and may need assistance in determining the big ideas (i.e., fundamental principles, concepts, and themes) and appropriate practices of geography to teach their students. Therefore, instructional materials should focus on big ideas, which are identified in the second edition of *Geography for Life: National Geography Standards* (Heffron & Downs, 2012), to help students make sense of geography and continue developing key understandings across learning experiences. Furthermore, instructional materials should illustrate how geographers "think" about questions and problems, providing students with models for "thinking

geographically" and creating opportunities for students to practice this type of thinking. Instructional materials should convey a sense of purpose for learning big ideas and practices and should include a strategic sequencing of learning experiences within and across grade levels. In addition, the materials should include geographically accurate content that honors diverse perspectives.

Recommendation 2: Design instructional materials that build upon students' prior geographic knowledge and experience and challenge students' thinking.

Students are naturally curious about how the world works—both in terms of physical processes and human experiences. Geography is a discipline that can excite this curiosity, and it also can build upon and enrich the knowledge students have developed about their world. Instructional materials should capitalize upon this potential by demonstrating to students that geography is a dynamic and active discipline that is relevant to their daily lives. Acknowledging and building on the ideas and experiences students bring to the classroom is an important component in the learning process. This allows students to strengthen their conceptions while addressing any misconceptions they might have about various aspects of geography. Therefore, instructional materials in geography need to offer classroom activities that elicit students' ideas, and provide information and tools for teachers to anticipate and respond to these ideas. Connecting to or drawing from the rich diversity of students' prior knowledge and experiences relevant to geography, materials should include learning opportunities that take advantage of students' curiosities and interests and include thoughtful questions, discussions, and other activities to challenge student thinking.

Recommendation 3: Develop instructional materials that use teaching strategies to engage all learners in meaningful explorations of geography.

To make day-to-day instructional decisions, all teachers need to be equipped with a diverse repertoire of methods and strategies proven effective to teaching geography. Instructional materials are potentially the most useful resource for helping teachers craft productive learning experiences that meet the needs of their students. Developers of such materials can thoughtfully design learning experiences based on contemporary geography, and on the likely experiences students bring to the classroom, to help teachers understand and utilize the best teaching methods and strategies available. At present, many of the instructional materials in geography utilize limited methods for conveying content—typically promoting direct instruction through lecture, reading, and recitation. Most students do not respond well to these learning conditions, and such modes of instruction do not take advantage of one of geography's greatest assets—that it is a dynamic discipline with a high degree of relevance to students' lives. Programs should engage students in asking questions about contemporary geography issues and problems. They should immerse students in the study of their local geography and connect geography to students' lived experiences. Programs should use teaching methods that capitalize on geographic tools to create vivid firsthand and vicarious experiences, engage all students using diverse modes of instruction, and attend to the inevitable differences among students in a classroom. Programs should build disciplinary language and engage students in the application of geography content and practices within a broad range of contexts.

To support teacher learning in geography..

Recommendation 4: Design instructional materials to be learning tools for teachers.

The design and implementation of most instructional materials focus on supporting *student learning*. Developers provide guides to help the teacher navigate features in the materials but, for the most part, the idea of designing instructional materials to support *teacher learning* is not at the forefront of developers' plans. Given the importance of teachers in shaping what students learn, it makes sense that curriculum developers should pay more attention to what teachers know and how teachers make decisions about their curriculum. Recently, some developers have proposed design features to support teacher learning from the materials. These features are not simply step-by-step instruction manuals, or "how-to guides" for using materials. Instead, the materials serve to support teacher learning as well as to guide student learning. Teacher learning is a complex process of building and integrating knowledge of the discipline with knowledge of teaching practice and student learning (Davis & Krajcik, 2005). Given such complexity, designing instructional materials to be educative for teachers is no simple task. This requires developers to step outside their comfort zone and take a new look at the purpose and goals of materials design.

Recommendation 5: Develop and implement professional development programs that enrich teachers' knowledge of contemporary geography and how to teach it.

Teachers need to have two fundamental types of knowledge to design and carry out meaningful learning experiences for their students: content knowledge and pedagogical content knowledge. In other words, to teach geography well, teachers must have a deep knowledge of the discipline, and how to teach it, in order to improve student learning of the big ideas and practices of geography. However, many teachers of geography do not enter the profession with rich understandings of geography concepts and how to teach them. In most schools, geography is taught as part of the social studies or science curriculum; in elementary schools, geography also may be integrated into reading and writing activities. In these cases, coordinated teaching and learning of the big ideas and practices of geography often is limited. Furthermore, knowledge of geography and how to teach it is not static but changes as disciplinary knowledge develops over time. This means that content-focused opportunities for professional development in geography are essential—even for teachers with adequate preparation in geography—at the outset of and throughout their teaching careers. These opportunities should focus on enhancing teachers' knowledge of geography and how to teach it, and they should give teachers the opportunity to do geography themselves. Programs should include geography content to prepare teachers for skillful instruction within the discipline and to improve teachers' understanding of instructional strategies and methods proven most effective in engaging students in learning specific geographic big ideas and practices.

Recommendation 6: Design and implement coherent and sustained professional development programs with clear and measurable goals.

Professional development programs should create excitement and curiosity for learning geography and should leave teachers eager and prepared to help students develop rich understandings of geography. Professional development designers and providers must recognize teachers as learners, engage them in reflective practice, and encourage their commitment to teaching the discipline over the course of their careers. Professional development programs should promote a meaningful and relevant learning environment for teachers while moving beyond the "one-shot" workshop approach to create a vision of professional development as a sustained process throughout a teacher's career. The aim of high-quality professional development in geography is to help teachers continually reflect on their current teaching so that they include research-based best practices that are tailored to meet the needs of their specific students and contexts. Therefore, professional development should be guided by a vision of effective geography teaching and learning, and should use a model based on a theory of teacher learning with clearly articulated goals and measurable outcomes. Professional development should attend to the needs, challenges, and constraints of local teachers, schools, and communities and should provide specific and usable approaches to bridge the gap between the vision for the professional development and the reality in schools. Programs should develop a plan that clearly considers the logistics and requirements of implementing high-quality professional development in concordance with the program's vision and goals. Finally, program developers should recognize that change is gradual and sometimes difficult in educational settings and, thus, programs should provide for ongoing support and sustainable professional learning activities for teachers.

Recommendation 7: Enhance preservice teacher education programs to emphasize teaching geography across subjects and grade levels.

Most teachers begin their professional development in preservice education programs to build their proficiencies in teaching. Preservice education programs for elementary and secondary educators who will teach geography in a single or interdisciplinary learning environment should provide the necessary teaching and learning experiences to ensure proficiency in teaching contemporary geography. Unfortunately, current teacher preparation programs lack emphasis on teaching geography in preparing both elementary and secondary teachers. Therefore, high-quality preservice education for prospective teachers should provide coursework that promotes a wide and balanced understanding of geography, helps preservice teachers develop geographic perspectives and skills, and prepares them to teach students to use geographic thinking and reasoning effectively. In addition, field placements should allow preservice teachers to observe, inquire about, benefit from, and practice with the most effective models and examples of geography instruction during their field placements, student teaching, and internship teaching experiences. Preservice teachers should have knowledgeable, experienced, and motivating mentors who support and guide their early teaching experiences in geography.

To support large-scale collaboration and change...

Recommendation 8: Develop and fund extensive research and evaluation in geography instructional materials and professional development.

Instructional materials and professional development programs should be studied to determine what is working and what is not working within programs, and how varied program components contribute to improve teacher knowledge and practice as well as student learning. Both research and evaluation are vital tools for gathering empirical information about instructional materials and professional development. As such, research and evaluation should be pursued to help create a research base, provide evidence, and inform decision making in geography education. The geography education community should engage in a strategic research agenda about instructional materials and professional development. Research questions should be connected, focused, and should build upon the findings of previous studies within geography education and related areas of study, advancing the knowledge in this field. For research and large-scale change to occur, funding is required to support programs seeking to advance this agenda. Three promising areas for future research in geography education include design-based research, learning progressions, and uses of technology tools for learning.

Recommendation 9: Create opportunities for sustained and authentic collaboration among geographers, education researchers, and practitioners.

A broad range of individuals representing various academic fields and occupations have expertise in geographic education. Geography professionals, K–16 education practitioners, and education researchers/developers play interrelated roles in creating high-quality instructional materials and professional development programs. Too often in creating instructional materials and professional development, the contributions of one key group or another are non-existent or merely symbolic. We encourage geographers, educational researchers, and practitioners to collaborate in ways that are authentic and sustained throughout the development process—from inception to implementation, evaluation, and revision. Project-specific collaboration is the first step in creating long-term change in the field, but it alone is insufficient. Geographers, education researchers, and practitioners need to develop a culture of collaboration that exists independent of grant-funded and time-delimited projects. Geographers need forums for understanding geography education; practitioners need forums for understanding the dynamic field of geography and how it pertains to the world beyond the school walls; and developers need access to both geographers and practice settings to meld designs with research findings. These forums will require significant resources to develop and sustain, including both funds and the commitment of individuals and groups across multiple professional communities.

Recommendation 10: Design and disseminate tools and exemplars to inspire and support educators, developers, and policy makers in leading the implementation of these recommendations.

Most education materials and tools—student textbooks, teacher guides, educational games, simulations, and the like—are designed to support teachers and students in the classroom. Very few are designed specifically to support and guide professional development leaders and designers, teacher educators, instructional materials developers, researchers, and policy makers. Geography education leaders need new tools and illustrative examples to support them in developing a deep and shared understanding of contemporary geography education and to guide them in changing the ways they support, fund, and develop instructional materials and work with teachers. Carefully developed tools and illustrative examples, such as accessible videocases of effective teaching strategies for preservice educators and web-based maps of student learning progressions about central concepts and practices in geography, will support these leaders and help the field develop and implement instructional materials and professional development programs that meet the needs of today's learners.

Taking Action

When this Committee first convened, the members clearly stated their intent to develop a report that is *useful* in the field of geography education. We recognize that it takes a diverse and committed audience of geographers, educators, researchers, developers, funders, and policy makers to enact large-scale change, and we developed this report with every important audience member in

mind. Therefore, the report can be used flexibly and for a variety of purposes for different groups within that audience. For example, part of this report can be used by administrators to lead materials adoption meetings and by publishers to guide the development of materials. Another part can be used by Geographic Alliance coordinators to create professional development programs, and yet another section can be used by researchers to develop grant proposals. Developers, educators, funders, and policy makers can use the recommendations and guidelines in this report to assist them in designing, sharing, and implementing research-based instructional materials and professional development programs that support effective teaching and learning in geography.

Various stakeholders can support the vision of this Committee and address the goals of this report in multiple ways. We provide some examples of such actions in a section of the report titled "Taking Action," including the following:

Local, State, and National Policy Makers and Funding Organizations

- Provide financial and political support for school and informal education programs that prepare students for careers requiring an understanding of geography and geospatial skills, currently one of the highest U.S. job-growth areas.
- Advocate for state and federal legislation that supports the teaching and learning of geography (e.g., the Teaching Geography Is Fundamental Act).

Curriculum Developers

- Craft materials that incorporate effective and engaging strategies and methods and that are designed in collaboration with teachers who use these strategies to help students develop deep understandings of geographic big ideas and practices.
- Develop materials that focus on depth of geographic understanding around big ideas and practices rather than on superficial coverage of content (i.e., geography facts).

Professional Development Providers and Developers

- Use the recommendations and guidelines in this report to support the development, implementation, and evaluation of successful professional development programs.
- Provide opportunities for long-term and sustained professional development in geography.

Teacher Educators and University Faculty

- Develop collaborative relationships among education; geography; and science, technology, engineering, and mathematics (STEM) faculty to support geographic literacy of the college students who will lead tomorrow's classrooms.
- Promote alignment and integration of preservice education program components to present a cohesive and coordinated approach to understanding geography big ideas and practices.

Teachers

- Provide dedicated instructional time each day throughout the year for sustained learning of geography.
- Avoid teaching geography as simply a litany of locations—the "where" constitutes the basic alphabet of geography, but sophisticated geographic thinking focuses on the "why there?" and the complex connections between places.

District and School-Level Administrators

- Identify, hire, and support teachers with geographic expertise (or the willingness to learn via inservice professional development).
- Demonstrate to parents that geographic literacy is a priority in the school and district.

Parents/Caregivers

- Read stories that are set in diverse places around the world.
- Advocate for geography in your school's curriculum.

While the Committee understands that barriers exist preventing many classrooms from being adequately equipped for this vision of geographic learning, and we acknowledge that educators have competing demands for limited resources, including time for professional development, we assert that the benefits of a geographically literate population are well worth the costs of overcoming these barriers. Reformers, educators, and leaders today promote 21st century learning as preparing students for college, career, and good citizenship. Effective teaching and learning of geographic literacy prepares students—and their communities—for success in all of these areas.

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Preface

Background

This report is a product of the Road Map for 21st Century Geography Education Project. The Road Map Project has its origins in a directive from Congress in the 2010 budget appropriation for the National Science Foundation (NSF) that instructed the Foundation to "work with external partners with experience in geographic education to improve geography teaching, training, and research in our Nation's schools" (U.S. House of Representatives, 2009, p. 767).

In the spring of 2010, the National Geographic Society responded to this opportunity with a proposal to work with three other national organizations—the Association of American Geographers, the American Geographical Society, and the National Council for Geographic Education—to create a "road map" for efforts to improve geographic education. Building on three decades of collaboration, the partners argued that it was time to launch an initiative that would have large-scale impact across the United States over the course of the new decade. They proposed to undertake the Road Map Project to construct plans for the initiative. The project's goal would be to learn from the lessons of earlier educational improvement efforts in geography and other subjects to establish guidelines and set priorities for this new initiative.

Following extensive review, the National Science Foundation awarded a grant to support the Road Map Project in September 2010.

Project Structure

The Road Map Project was organized into four parallel efforts. Three efforts were headed by committees that were tasked with creating reports that review the current status of their area of expertise and establish recommendations for the future. The fourth effort—a study of public understanding and values—developed a survey, administered it, and analyzed its results.

As part of the proposal process, the partner organizations identified chairs and co-chairs for the three committees and a director of the study. Each of the partner organizations served as the administrative host for one of the project's four efforts and provided professional staff and administrative support for that effort. The four efforts, their hosts, and their chairs, as established by the partners, were:

- **Instructional Materials and Professional Development Committee**
  Administrative host:
  National Council for Geographic Education
  Chair: Emily M. Schell
  Co-chair: Kathleen J. Roth
- **Assessment Committee**
  Administrative host:
  National Geographic Society
  Chair: Daniel C. Edelson
  Co-chair: Richard J. Shavelson
- **Geography Education Research Committee**
  Administrative host:
  Association of American Geographers
  Chair: Sarah Witham Bednarz
  Co-chair: Susan Heffron
- **Study of Public Understanding and Values**
  Administrative host:
  American Geographical Society
  Director: Jerome E. Dobson

Once the project was funded, the project partners established a Steering Committee consisting of one representative of each of the partner organizations, the committee chairs and co-chairs, and the project director.

Report Development Process

Each report was created by a committee convened by the partners. It represents a consensus of the members of the committee. All three of the consensus reports created by the Road Map Project were developed following the same process, described below.

Committee Formation

The committees were recruited from lists of nominees and alternatives recommended by the Steering Committee. The committees were constructed to have representation from all of the following:

- academic experts in geographic education,
- academic geographers,
- academic experts in education in other areas of social studies and science,
- K–12 practitioners (teachers and administrators),
- experts in the specific foci of each committee (assessment, professional development, instructional materials development, educational research), and
- perspectives from outside the United States.

The Steering Committee wrote initial charges to the committees based on the goals of the original project proposal. Specifically, the Instructional Materials and Professional Development Committee was charged with making recommendations about the design of instructional materials and the education of teachers. The Assessment Committee was charged with developing a framework for assessing progress toward geographic literacy across the progression from kindergarten through high school. The Geography Education Research Committee was charged with developing an agenda for educational research that would lay out questions about learning, teaching, and educational change that must be answered to maintain the effectiveness of geographic education into the future.

The chairs and co-chairs of the three committees, together with the project director and the committee research directors, formed a leadership team with the purpose of ensuring coordination and collaboration across their committees. The members of the leadership team maintained close communication with each other, but each committee was empowered to make its own decisions and to exercise independent editorial judgment over its own product. Each committee received substantial input and feedback from a variety of sources. However, they were not required to obtain approval for their products from their host organization, any of the other partner organizations, the National Science Foundation, or any other outside individual or organization. As a result, their reports reflect the opinions and judgment of their authors.

Research and Draft Phase

Each of the committees met for a kick–off meeting in Washington, DC, in January 2011. As part of their kick–off meeting, each committee reviewed and refined its charge. Once the committees were convened, they were given final editorial authority over their reports; all input from other sources was treated as advisory. The committees were each staffed by a research director with a doctorate in a related field and provided with a budget to seek input from outside experts. Each committee met face-to-face several times over the course of the research and writing process, in addition to conducting regular conversations via conference call. Information sharing among committees was facilitated through regular conversations among research directors and chairs/co-chairs.

All three committees collaborated on the organization of a workshop on geographic thinking in June 2011. The intent of this workshop, held in Washington, DC, was to bring together individuals who have insights into "expert" geographic thinking to address a series of questions related to the committees' interests in describing geographic literacy. Prior to the workshop, through a series of conference calls and online discussions, the committees identified a set of core questions they sought to have addressed at the workshop. Questions addressed at the workshop included

- "How do geographers reason about space?"
- "How do people develop spatial reasoning?"
- "How do professionals in geographic fields apply geography?"
- "How do geographers frame questions and problems differently compared with other fields?"
- "How do you train geographers?" and
- "What can we learn from how other disciplines have characterized skills, practices, and ways of thinking?"

The presenters at this workshop are listed on page 17. In addition, the Instructional Materials and Professional Development Committee held a workshop and a series of invited talks online focusing on issues of importance for this report. All of these presenters are listed on page 18.

Following the workshop, as part of their work on the reports, all three committees conducted additional research activities specific to their charge. Each of the three committees held face-to-face meetings in September 2011, January 2012, and April/May 2012 to work on draft-related tasks, resolve open issues, and plan work going forward.

Review and Comment Phase

Cross-committee review. First drafts of proposals were distributed to the other committees for review in January 2012. Each committee identified two to five representatives to review the other committees' reports. The intent of this review was to identify any cross-committee issues that needed to be addressed, and to give each committee input and feedback they might incorporate prior to public review. Each of the committees then met in person or via conference call to discuss the feedback and determine how to incorporate it into their next draft.

Public review. Revised drafts of the reports were made available for public comment in March 2012. The release of the draft reports was announced on the project website, and announcements about the public review

were distributed to members of the Association of American Geographers, the American Geographical Society, the National Council for Geographic Education, and the National Geographic Alliance Network. All of the presenters at the June 2011 Geographic Thinking Workshop, as well as others who had contributed to the work of the different committees, were invited to comment as well.

Review Board. In an effort to ensure that the committees would obtain feedback from important constituencies for the reports, the leadership team reached out to organizations in related fields to help construct a formal Review Board for the reports. Eleven organizations were contacted and asked to nominate members or representatives of their organizations to review each of the reports. Of these, eight organizations nominated individuals. From this group, 15 individuals provided reviews of one or more reports each. The nominating organizations and the members of the Review Board are listed on page 16.

Final Preparation

Following the completion of the public and Review Board reviews, the committees carefully reviewed all of the comments received. The committee chairs, co-chairs, and directors met in Washington, DC, in April 2012, to discuss the themes that arose from the feedback and construct plans for how to address them. Each of the committees then met in late April/early May to discuss the feedback in greater detail, work on their responses, and finalize plans for completing the final drafts of the reports.

Final drafts of the reports were submitted for editing and layout in August 2012.

Dissemination

Following the publication of the reports, the four partner organizations will engage in a dissemination effort in order to bring the reports to the attention of their target audiences and to educate policy makers, funders, and front-line educators about the reports' findings and recommendations. They are being assisted in this effort by an Advisory Board. The members of the Advisory Board have reviewed and endorsed the reports and are committed to helping the partners achieve their dissemination goals. The Advisory Board members are listed on page 5.

Scope and Terminology

In a subject-specific educational project such as this, it is important to be explicit about the scope of the project. This is particularly important for geographic education, because there is so much confusion about the nature of geography and its relationship to the K–12 curriculum.

For this project, the partners chose to use the national standards document *Geography for Life: National Geography Standards,* Second Edition, as the scoping document (Heffron & Downs, 2012). *Geography for Life* lays out a scope for geographic education that cuts across the traditional boundaries of social studies and science in American schools, reflecting the fact that geography is concerned with both the physical world and the social world.

While the scope of geographic education as defined by *Geography for Life* is consistent with the way academic geographers define the field of geography, it is inconsistent with the way the term *geography* is used in most American schools and with the understanding of the term by many members of the general public. In most American schools and in the minds of the general public, the term *geography* refers to a set of basic map-reading skills; a collection of facts about place names and locations; and a body of information about people, places, and cultures around the world. Further, in American schools *geography* is a part of the social studies curriculum and is not recognized as including the substantial components of physical, life, and earth sciences included in *Geography for Life.*

For readers who are unfamiliar with the contents of *Geography for Life,* we encourage them to familiarize themselves with it prior to reading this report. We also recommend that all readers bear in mind that when the term *geography* appears in this report, it refers to the full range of knowledge, skills, and perspectives described in *Geography for Life*[1], not only those that are taught under the label of "geography" in schools today. In particular, the range includes elements of the social sciences, which typically are taught as part of the social studies curriculum in American schools, and elements of the physical, life, and earth sciences, which typically are taught as part of the science curriculum.

[1] In the original proposal to NSF, the partners used the term geographical sciences to describe the project's scope. For the sake of readability, we decided to use geography in the project reports. This change in terminology does not reflect any shift in the focus of the initiative in the intervening time.

Acknowledgments

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The Instructional Materials and Professional Development Committee is grateful for the input received throughout the development of this report. While our Committee's expertise is diverse and broad-ranging, we believed that it was best to consult with a larger group of experts to come to consensus on the recommendations and guidelines developed in this report. We drew upon experts in geography and geography education, science education, social studies education, education research, and the learning sciences through workshops, webinars, focus groups, panel sessions, and public reviews. We learned from those who develop, evaluate, and benefit from instructional materials and professional development. This Committee would also like to acknowledge the individuals and organizations who shared their stories with us to create the "Geography in Practice" vignettes within this report. These educators work tirelessly to inspire our students, as well as the whole community of geography education, through their creativity, commitment, and passion for teaching geography.

This report represents a collaborative and scholarly effort from a large group of authors. In addition to the writing and editing contributions from each committee member, we also received writing contributions from outside experts. First we would like to acknowledge the expertise and writing contributions from Lindsey Mohan, who was our lead writer on instructional materials (Recommendations 1 to 4). We also acknowledge the writing contributions from Sandra Schmidt, for her work on "Geography in Practice: Contesting Boundaries," Elena Takaki and Anne Pollard Haywood, for writing "Geography in Practice: FieldScope," as well as the contributions of Megan Webster to our literature review on geospatial technologies in K–12 teaching and learning.

We would like to thank the presenters at the Workshop on Geographic Thinking in Washington, DC, on June 16–17, 2011 and the Professional Development and Instructional Materials Workshop in Washington, DC, on June 18, 2011. We would also like to thank the individuals who presented at a series of webinars we hosted on geospatial technologies and online learning. We extend a sincere thank you to Barbaree Duke for facilitating and archiving these webinars.

The Instructional Materials and Professional Development Committee also hosted focus groups and a public review to gather feedback on our recommendations and guidelines. We thank all those who participated in and contributed to this report with their thoughtful ideas and revisions. In particular we would like to thank Biological Sciences Curriculum Study (BSCS) for reviewing our guidelines, and we thank Michal LeVasseur and Martha Sharma for providing feedback on "Geography in Practice: AP Human Geography."

We would like to thank NCGE presidents and staff for making this work possible: Kristi Alvarez, Zach Dulli, Eric Fournier, Joseph Kerski, and Jacqueline Waite; and we also extend a thank you to the National Geographic Society, the Association of American Geographers, and the American Geographical Society for their support and collaboration throughout the entire Road Map Project. In particular, we thank the other Committee chairs, co-chairs, project director, and Committee research directors for their feedback across all three reports: Sarah Witham Bednarz, Daniel Edelson, Susan Heffron, Niem Tu Huynh, Virginia Pitts, Richard Shavelson, and Jill Wertheim. Finally, a sincere thank you to the staff at National Geographic, and in particular Jamie Bosley, for logistical support throughout this project.

Emily M. Schell, Chair
Kathleen J. Roth, Co-Chair
Audrey Mohan, Research Director

Road Map for 21st Century Geography Education Project

Review Board

The following organizations nominated reviewers to serve on the Review Board of the Road Map for 21st Century Geography Education Project:

- **American Association for the Advancement of Science** (AAAS)
- **American Federation of Teachers** (AFT)
- **American Geosciences Institute** (AGI)
- **Council of State Social Studies Specialists** (CS4)
- **National Board for Professional Teaching Standards** (NBPTS)
- **National Council for the Social Studies** (NCSS)
- **National Education Association** (NEA)
- **North American Association for Environmental Education** (NAAEE)

By participating in this review process, these organizations and individuals made an important contribution to the Road Map for 21st Century Geography Education Project. However, they were not asked to endorse the reports that they reviewed, so the participation of these organizations and individuals does not constitute an endorsement of the reports. While the members of the Review Board were nominated by organizations, they did not represent the views of their organizations in the review process.

The following individuals nominated by these organizations reviewed one or more of the Road Map Project Committee reports:

Assessment Committee Report

- **Ann Benbow** (AGI)
- **John Lee** (NCSS)
- **Glen MacDonald** (AAAS)
- **Lauren Mitterman** (NBPTS)
- **Sheryl Mobley-Brown** (AFT)
- **Dean Nakanishi** (NBPTS)
- **Alan Reid** (NAAEE)

Geography Education Research Committee Report

- **Fay Gore** (CS4)
- **Jackie Huntoon** (AGI)
- **John Lee** (NCSS)
- **Glen MacDonald** (AAAS)
- **Sheryl Mobley-Brown** (AFT)
- **Bora Simmons** (NAAEE)
- **Robin Wheeler** (NEA)

Instructional Materials and Professional Development Committee Report

- **John All** (AAAS)
- **Stephanie Hartman** (CS4)
- **John Lee** (NCSS)
- **Sheryl Mobley-Brown** (AFT)
- **Kevin O'Brien** (NBPTS)
- **Judith Wilson** (NEA)

Road Map for 21st Century Geography Education Project

Presenters

Workshop on Geographic Thinking

Washington, DC, June 16–17, 2011

The following invited speakers presented at a workshop on geographic thinking convened by all three committees of the Road Map for 21st Century Geography Education Project in June 2011:

Thomas Baerwald
National Science Foundation

Douglas Batson
National Geospatial-Intelligence Agency

Scott Bell
University of Saskatchewan

Sarah Brinegar
U.S. Department of Justice

Roger Downs
The Pennsylvania State University

Richard Duschl
The Pennsylvania State University

Carol Gersmehl
New York Geographic Alliance and
Renaissance Charter School

Phil Gersmehl
Michigan Geographic Alliance and
New York Center for Geographic Learning

Patricia Gober
Arizona State University

Susan Hanson
Clark University

Kim Kastens
Columbia University

Lynn Liben
The Pennsylvania State University

Janice Monk
University of Arizona

Daniel Montello
University of California, Santa Barbara

Alec Murphy
University of Oregon

Nora Newcombe
Temple University

Jeanette Rice
Rice Consulting, LLC

Peter Seixas
University of British Columbia

Road Map for 21st Century Geography Education Project

Additional Presentations on Instructional Materials and Professional Development

Workshop on Instructional Materials and Professional Development

Washington, DC, June 18, 2011

The following individuals presented at a workshop on Instructional Materials and Professional Development held on June 18, 2011 in Washington, DC:

Janet Carlson, BSCS

Phil Gersmehl, Michigan Geographic Alliance and New York Center for Geographic Learning

Cindy Passmore, University of California, Davis

Brian Reiser, Northwestern University

Ann Rosebery, TERC

Jo Ellen Roseman, American Association for the Advancement of Science

Beth Warren, TERC

Donald Young, University of Hawaii at Manoa

Webinar Series on Instructional Materials and Professional Development

Summer and Fall 2011

The following presented in a series of online seminars on geospatial technologies and online learning between July and November, 2011:

Barry Fishman, University of Michigan

Anne Pollard Haywood, National Geographic Society

Joseph Kerski, Esri

Sean O'Connor, National Geographic Society

Anita Palmer, GISetc

Roger Palmer, GISetc

Elena Takaki, National Geographic Society

Anna Switzer, National Geographic Society

Chapter 1: Context and Goals for the Road Map for 21st Century Geography Education Project

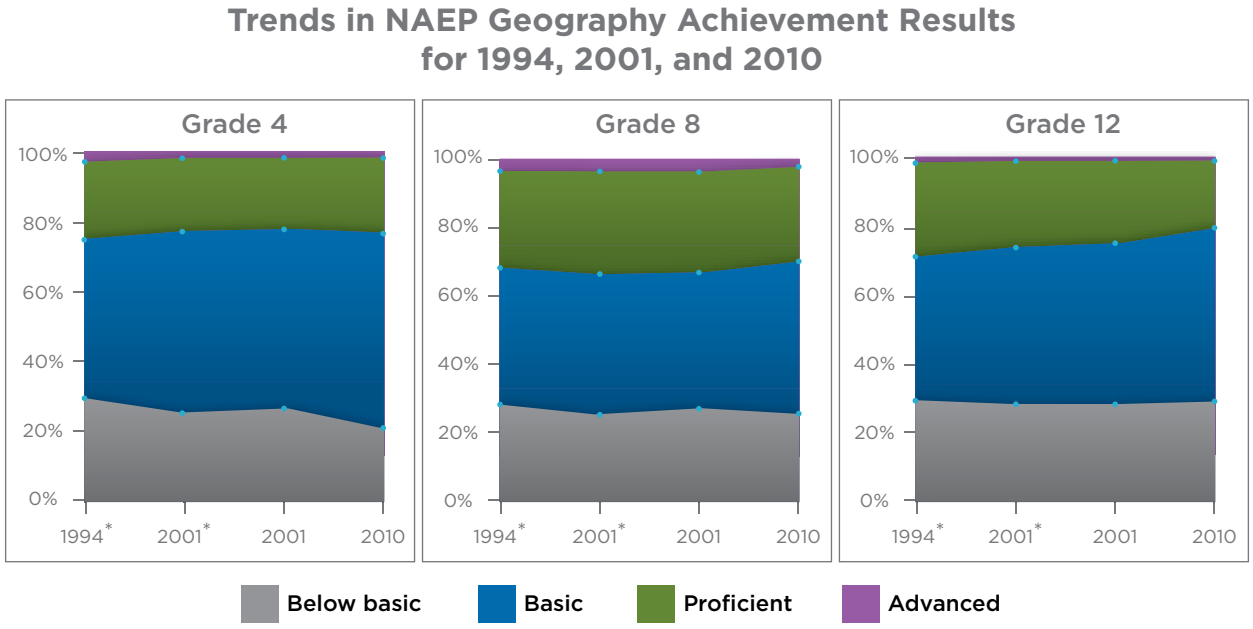
The State of Geography Education in the United States

This report is one of three synthesis reports on geography education from the Road Map for 21st Century Geography Education Project. The Road Map Project has been a collaborative effort of four national organizations: the American Geographical Society (AGS), the Association of American Geographers (AAG), the National Council for Geographic Education (NCGE), and the National Geographic Society (NGS). These organizations share a concern that the dismal state of K–12 geography education across the United States is a threat to our country's well-being, and by extension, the well-being of the global community. The project partners share the belief that geography education is essential for preparing the general population for careers, civic lives, and personal decision making in contemporary society. It also is essential for the preparation of specialists capable of addressing critical societal issues in the areas of social welfare, economic stability, environmental health, and international relations. The Road Map Project partners fear that by neglecting geography education today, we are placing the welfare of future generations at risk.

While inspiring examples of highly effective geography education can be found in every part of the United States, the amount of geography instruction that the overwhelming majority of students receive, the preparation of their teachers to teach geography, and the quality of their instructional materials are inadequate to prepare students for the demands of the modern world. Assessments of geographic concepts and skills confirm the failure of our educational system in geography, indicating that the overwhelming majority of American students are geographically illiterate. The 2010 National Assessment of Educational Progress (NAEP), known as "The Nation's Report Card,"(National Center for Education Statistics, 2011) found that fewer than 30% of American students were proficient in geography; more than 70% of students at fourth, eighth, and 12th grades were unable to perform at the level that is expected for their grade (NCES, 2011, Figure 1). At 12th grade, more than 30% of students scored below "basic," indicating that they had not mastered even foundational geographic concepts or skills.

From the NAEP results and other data, we conclude that an overwhelming majority of high school graduates are not prepared to do the ordinary geographic reasoning that is required of everyone in our society in the course of caring for themselves and for their families, making consequential decisions in the workplace, and participating in the democratic process. Furthermore, we conclude that more than 30% of high school students

Figure 1. Comparison of Results for Students in Grades 4, 8, and 12 on National Assessment of Educational Progress (NAEP) Geography Test in 1994, 2001, and 2010



*Test administrations in which accommodations were not permitted

Source: NCES, 2011

are so far behind that it is unlikely they will ever reach proficiency. To compare with textual literacy, this level of geographic illiteracy is analogous to having 70% of high school graduates unable to read a newspaper editorial and identify the assumptions, evidence, and causal connections in its argument.

The Importance of Geography Education

K–12 geography education is critical preparation for civic life and careers in the 21st century. It also is essential for postsecondary study in a wide range of fields, from marketing and environmental science, to international affairs and civil engineering.

Everyone in modern society faces personal decisions that require geographic reasoning. These decisions, such as where to live and how to travel from place to place, can have an enormous impact on one's life. We also must make decisions that have far-reaching consequences, such as which products to buy and how to dispose of them. While these decisions may seem insignificant, when they are multiplied by the number of people making them each day, they have enormous cultural, economic, and environmental repercussions for other people and places. Finally, in our democratic society, we all participate in societal decision making about public health, social welfare, environmental protection, and international affairs. In this era of such global challenges as ethnic and religious conflict, growing populations in poverty, increasing competition for limited natural resources, and degradation of the environment, it is essential that all members of society be prepared to make these decisions. Geography education helps prepare people for these tasks.

In addition, we need to provide young people with the opportunity to develop the understanding and interest to pursue the geography-dependent careers that are critical to our national interests. The Geo-Literacy Coalition, a consortium of businesses including Google, CH2M HILL, Esri, and the U.S. Geospatial Intelligence Foundation, had the following to say about the importance of geography education for our nation (National Geographic, 2011):

> [America's] inattention to [geography education] stands in contrast to the demand for geographically literate individuals in the workforce. There is substantial demand in both the public and private sectors for people who have the ability to interpret and analyze geographic information. The number of jobs for such analysts is growing rapidly, while the supply of Americans who can fill them is not. By not preparing young people for careers that depend on geographic reasoning, we are leaving ourselves vulnerable.
>
> In our global economy, the understanding and analytical skills developed through geography education are essential to make well-reasoned decisions about where to conduct business, how to conduct business in particular locations, and how to transport materials and goods from one location to another. Critical business choices such as where to build facilities, how to design a supply chain, and how to market to different cultures all require geographic reasoning.
>
> These skills are equally important for emergency preparedness, defense, intelligence, and diplomacy. In our government and military, we need individuals who understand the dynamics of specific locations well enough to prepare for and respond to emergencies. We need analysts who are able to track people and events around the world and put appropriate responses forward for decision-makers. We need people who are able to operate on the ground in every kind of foreign context and can read the cultural and physical landscape appropriately.

This Road Map Project is taking place against a backdrop in which many members of the global community are renewing their commitment to geography education. In Australia, a national curriculum is being introduced for the first time. In England, geography is a component of the recently introduced English Baccalaureate. In most of the world, geography holds a higher place in the K–12 curriculum than it does in the United States. In most countries, geography is required every year through age 16, in addition to history or other social studies subjects. In fact, the United States is almost unique in its treatment of geography as part of a single curriculum with history, government, and economics.

The Road Map Project partners believe that we, as a society, have a responsibility to prepare all young people for their personal needs and civic responsibilities, and we have a further responsibility to prepare sufficient numbers of young people for geography-dependent careers. We are not currently living up to those responsibilities, and we fear the consequences that our society will suffer if we continue to neglect geography education.

The Need for a "Road Map" for Geography Education

Over the past several decades, a small but dedicated community of geographers and educators has harbored concerns about the state of geography education and

has worked diligently to improve geography education. Their greatest success has been in establishing a firmer place for geography in K–12 education. The Elementary and Secondary Education Act (ESEA) of 2001 (January 8, 2002) recognized geography as a core academic subject, and all 50 states now have K–12 standards for geography. Geography has been included in the National Assessment of Educational Progress since 1994, and the College Board established an Advanced Placement exam for Human Geography in 2001.

However, these successes in improving the place of geography in the educational system have not been followed up with the levels of effort or resources necessary to bring about widespread improvement in the quality of instruction. As a result, educators and students who have had the good fortune of being impacted directly by the efforts of the geography education reform community have benefited enormously, but they represent a small minority. As measured by NAEP, there has been no broad improvement in students' learning of geography during the 17-year period of testing.

The project partners launched the Road Map Project with the goal of increasing the scale and accelerating the pace of efforts to improve geography education to meet our responsibility to prepare young people for the world they will inherit. The partners have two goals for this work:

- first and foremost, to make future efforts to improve geography education more strategic, focused, and coherent, so they can have greater and more enduring impact; and
- second, to provide a rationale for establishing requirements for geography education and allocating resources to improve geography education that accurately reflect its importance for our society.

This work targets the three audiences that are in the best position to effect improvement in our system of public education:

1. **Front-line professionals:** educators, teacher educators, developers, and researchers who directly influence instruction, assessment, and research;
2. **Policy makers:** individuals at national, state, and local levels who establish the goals and processes for public education; and
3. **Funders:** decision-makers in government and private organizations who provide the funding to support public education.

In planning the project, the partners identified five critical issues for improving geography education:

1. preparation and professional development of teachers,
2. instructional materials to support classroom instruction,
3. assessment of learning outcomes and instructional effectiveness,
4. research on teaching and learning, and
5. cultivation and maintenance of public support.

The partners divided these issues among four efforts, deciding to address the first four issues through synthesis reports to be developed by three committees of experts identified by the project partners:

The ***Instructional Materials and Professional Development Committee*** considered the current state of the instructional materials for teaching geography and the preservice and inservice education that teachers who are responsible for geography education receive. Based on this analysis and a review of the literature on the design of instructional material and the design of teacher professional development, the Committee formulated recommendations and guidelines for both instructional materials and professional development that will lead to improvements in instruction and in learning outcomes.

The ***Assessment Committee*** studied the current state of assessment in geography and reviewed its history. Based on their analysis of existing assessment practices and a review of the literature on assessment as a support for improving educational outcomes, the Committee formulated guidelines for developing assessment instruments and for conducting assessment that will lead to improvements in instruction and outcomes.

The ***Geography Education Research Committee*** reviewed the existing education and cognitive science research literature to identify gaps in our ability to answer significant questions about geography education based on research. Drawing on this analysis, the Committee formulated recommendations for research questions and approaches that will build a knowledge base to guide improvement efforts for geography education in the future.

For the final issue—developing and maintaining public support for geography education—the partners did not believe the existing knowledge base on public beliefs and attitudes about geography education would

support the development of a synthesis report at this time. Instead, the partners initiated a pilot study of public beliefs and attitudes under the direction of the American Geographical Society.

Establishing a Destination: Goals for K–12 Geography Education

The value of a road map is that it enables you to select a route to your destination. Therefore, the first step in developing our Road Map for geography education was establishing a common destination. In education, destinations are expressed in terms of learning outcomes, so in the case of geography education, we will be able to say that we have reached our destination when our schools make it possible for all students to achieve the learning goals for geography that we have set for them.

Because the national geography standards were developed through an earlier collaboration of the project partners, they represent a logical choice of "destination." However, the members of the Road Map Project committees thought we should use this opportunity to consider alternatives as well. Therefore, as a collaborative effort across all three committees, we conducted an investigation into what it means to "do geography" in the 21st century and what that implies for the goals of K–12 geography education. The remainder of this chapter describes that process and its outcomes.

Establishing goals for geography education is no small challenge because geography is a broad field and it is constantly evolving. Fortunately, geographers and others have wrestled with this challenge for generations, and we were able to benefit from that work. Our investigation was guided by three criteria that we believe the goals for K–12 geography education should meet. Specifically, goals for geography education should:

1. reflect the essence of geography as defined by geographers;
2. convey the qualities of geography that capture its distinctive benefits as a subject of study; and
3. focus on the portions of geography that have the greatest value for students and society.

We approached the challenge of defining the goals for geography education from two perspectives—those of geographers and educators. To explore the perspective of geographers, we surveyed the existing literature on the nature of geography, and we convened current thinkers and practitioners for a workshop on "geographic thinking." At this workshop, we invited a wide variety of academic and practicing geographers, cognitive scientists, and individuals with other relevant perspectives to present on what it means "to think like a geographer" or "to do geography." To explore the perspective of geography educators, we examined the history of efforts to conceptualize geography education during the past half century. We summarize the findings of these investigations below.

Geographers on Geography

We started our investigation with a review of the ways that geographers have defined geography in recent decades. While there is great diversity of opinion among geographers about where the boundaries of geography lie, there is considerable consensus about its core. Geographers engage in a range of activities related to space, place, and the dynamic interactions of agents within and across spaces and places (Baerwald, 2010; NRC, 1997). As described in a recent National Research Council report (NRC, 2010), geography involves:

> documenting, analyzing, and explaining: 1) the location, organization, and character of physical and human phenomena on the surface of Earth; and 2) the interplay of arrangements and processes, near and far, human and environmental, that shape the evolving character of places, regions, and ecosystems (p. 10).

This report characterizes geography as being forward-thinking and essential to society for key issues including sustainability, economic stability, national security, and response to environmental change.

A consensus also has evolved in recent decades about the key themes of geography. Pattison (1964) identified geography's core as consisting of four "traditions," the spatial tradition, the area studies tradition, the human-land tradition, and earth science tradition. Taaffe (1974) identified three key organizers for geography: spatial organization, area studies, and human-land relationships. Contemporary geographers agree that the discipline focuses on a similar set of core ideas: spatiality, human-environment interaction, interconnections between places, and place-based and regional analysis (Abler, 1987; Baerwald, 2010).

Because geographers work on many of the same questions and problems as specialists in other fields, they have faced the challenge of differentiating geography from those fields. Susan Hanson confronted this challenge in a presidential address to the Association of American Geographers. In this presentation, Hanson (2004) described the unique aspects of geography as

"the geographic advantage," and she enumerated four aspects of this advantage:

1. Geography considers *the relationships between humans and environments.* Because of the traditional separation of social and physical sciences, other disciplines tend to focus on one or the other.
2. Geography *recognizes the importance of spatial variability.* Geography offers unique methodologies for investigating the way phenomena vary with location and explaining the place-dependency of processes.
3. Geography *considers the multiple and interlocking geographic scales at which processes operate.* Geography also offers unique techniques for studying phenomena and how they play out over multiple spatial scales.
4. Geography *integrates spatial and temporal analysis.* With its focus on spatial variability, geography offers unique techniques for integrating the analysis of variation over time with analysis of variation over space. Many other disciplines have focused on analysis of temporal variability without attention to the spatial dimension.

Evolving Conceptions of the Goals of Geography Education

In addition to looking at how geographers have characterized geography in recent decades, we also looked at the goals that geographers and educators have articulated for geography education over that same period. During the past 50 years, four efforts to conceptualize the goals of geography education have had nationwide influence. In our investigations, we looked both at the ways they characterized the goals of geography education and at the influence they had. We summarize what we learned in the paragraphs that follow. Across these efforts, we observed two important trends: (1) an increase over time in their richness and clarity, and (2) an ongoing struggle to present a balance between what it means to "understand" geography and what it means to "do" geography.

The High School Geography Project (1963 to 1971).

Today's efforts to improve geography education have their roots in the wave of educational reform initiatives that followed the Soviet Union's launch of the Sputnik satellite in 1957. One of these initiatives targeted geography education, and it set a tone that has influenced all subsequent geography education reform efforts. The NSF-funded High School Geography Project (HSGP) was an instructional materials development initiative with the goal of transforming high school geography (Association of American Geographers, 1966). In a reflection on the project, the project director said, "With little hesitation, teachers [who were consulted in the design of the HSGP] voiced the same litany of problems…dull textbooks, inadequately trained teachers, simple factual content… training in history not geography, lack of emphasis on geography in schools of education..." (Helburn, 1998, p. 212). HSGP attempted to address many of these concerns by creating instructional materials that engaged students and teachers in asking and answering geographic questions using data and simulations, and by building professional development opportunities around the curricula. Essentially, HSGP was an attempt to reconceptualize geography education as the integration of geography inquiry and geographic understanding.

In practice, the long-term impact of HSGP turned out to be more a result of its ideas than its implementation. The unconventional HSGP units entered a challenging implementation environment in the late 1960s and early 1970s. The objective was to create a dynamic, participatory learning environment in which students observed that geography is a conceptually rich and useful subject for daily life in their communities and the larger world. Although the units were favorably reviewed and supported with teacher training, they differed significantly from existing materials and teaching practices. Further, the learning outcomes that the inquiry-based units targeted could not be assessed using conventional testing. Consequently, the HSGP was not widely adopted in American high schools. However, the project did engage a community of academic geographers in K–12 education for the first time in more than a decade, and it introduced a concept of the goals and methods of geography education to a new generation of educators. These two impacts helped to lay the groundwork for the next wave of reform efforts in the early 1980s.

The Guidelines for Geographic Education (1984).

The next influential effort to reconceptualize geography education began in the early 1980s following the publication of *A Nation at Risk: The Imperative for Educational Reform* (National Commission on Excellence in Education, 1983), which, like the launch of Sputnik, triggered a wave of educational reform efforts across the curriculum. In 1984, a joint committee of the Association of American Geographers and the National Council for Geographic Education published the *Guidelines for Geographic Education,* which was designed to provide a clear, comprehensive set of national goals for K–12 geography education (Joint Committee on Geographic Education, 1984).

The *Guidelines* established a concise framework for geography teaching that would be widely adopted in schools, in teacher preparation programs, and among publishers of geography texts and curriculum materials. The *Guidelines* described geography as consisting of three basic elements:

1. a geographic perspective (spatial and ecological ways of viewing the world);
2. fundamental themes (Location, Place, Human Environment Interaction, Movement, and Region); and
3. core skills (asking geographic questions, acquiring geographic information, presenting geographic information, analyzing geographic information, and developing and testing geographic generalizations).

With these three elements, the *Guidelines* continued the effort begun with the HSGP to present a vision of geography that integrates knowing with being able to do.

Following the publication of the *Guidelines*, the Association of American Geographers, the American Geographical Society, the National Council for Geographic Education, and the National Geographic Society joined together to create the Geography Education National Implementation Project (GENIP), which aimed to translate the *Guidelines* into practice. During the ensuing five years, GENIP produced two additional documents to help educators to implement the *Guidelines:*

- *K–6 Geography: Themes, Key Ideas and Learning Opportunities* (Geography Education National Implementation Project, 1987), and
- *Geography in Grades 7–12: Themes, Key Ideas and Learning Opportunities* (Geography Education National Implementation Project, 1989).

These seminal publications extended the teaching examples in the *Guidelines*, and they were widely distributed, increasing the influence of the *Guidelines*.

The impact of the *Guidelines* was impressive. The publication was remarkably successful in achieving widespread awareness of the five fundamental themes. Educators and curriculum developers found the five themes to be memorable, relatively easy to understand, and easy to apply in teaching geography. Thus, the themes were widely integrated into school curriculum guidelines, preservice and inservice professional development, and instructional materials produced by publishers, school districts, and professional organizations through the concerted efforts of the nascent Geography Alliance network sponsored by the National Geographic Society. To this day, the five themes continue to influence geography education in many school settings and teacher preparation programs.

Unlike the content themes, however, the geographic perspectives and skills in the *Guidelines* received scant attention. They were largely overlooked in subsequent materials development and professional development efforts. While the five themes were consistent with the general focus on knowledge of the educational reform efforts of the 1980s, the perspectives and skills in the *Guidelines* were not. Like the inquiry-based elements of the HSGP, integrating these perspectives and skills into educational practices would have required a larger change than most educators were comfortable making, particularly because the reform efforts of the 1970s were widely criticized at that time for an excessive focus on "process" at the expense of "content."

The *Guidelines*, which had a much broader impact than the HSGP, led to a broad-based reconceptualization of the content of geography in mainstream education. However, its influence was largely limited to the conception of content in terms of the five themes it presented. The *Guidelines*' depiction of geography as an integration of content, perspectives, and skills was largely overlooked.

Geography for Life: National Geography Standards (1994). The next major effort to articulate the goals of geography education began in response to federal legislation enacted in 1989. The Goals 2000: Educate America Act (1994) was passed in response to a renewed concern about the state of education in the United States. As a result of concerted efforts by the geography education community, geography was included as one of the five core subjects in the America 2000 reform plan. This recognition resulted in funding to create a national standards document for geography. (It was in this era that the term "standards" was introduced into the educational policy lexicon.)

With funding from the U.S. Department of Education, the National Endowment for Humanities, and the National Geographic Society, the four GENIP partners launched a standards-writing project. Over two years with extensive feedback and advice from a broad range of reviewers, advisory groups, and testimony at numerous public hearings, a diverse group of scholars and teachers created the first set of national standards for geography. In 1994, the product of this effort was published: *Geography for Life: National Geography Standards* (Geography Education Standards Project, 1994).

In contrast to the 26-page *Guidelines*, the 1994 edition of *Geography for Life* was 272 pages long. *Geography for Life* incorporated everything in the *Guidelines* in some form. For example, *Geography for Life* retained the *Guidelines*' three-part structure of perspectives, skills, and content. However, much was modified and added:

- The two geographic perspectives highlighted in the *Guidelines* were maintained in *Geography for Life:* spatial and ecological. They also were described in significantly greater detail than they had been in the *Guidelines.*
- The skills identified in *Geography for Life* are an elaboration of the skills described in the *Guidelines for Geographic Education.* They are: asking geographic questions, acquiring geographic information, organizing geographic information, analyzing geographic information, and answering geographic questions.
- Instead of the five themes discussed in the *Guidelines, Geography for Life* organized content around six essential elements (The World in Spatial Terms, Places and Regions, Physical Systems, Human Systems, Environment and Society, and The Uses of Geography). These essential elements were, in turn, made up of 18 content standards.

While *Geography for Life* took a large step toward presenting a picture of geography as integrating *knowing* and *doing* through its elaborate description of perspectives and skills, the authors were restricted by the constraints imposed on national standards documents at the time. Specifically, they were permitted only to use the term "standard" to label content objectives. For that reason, neither perspectives nor skills were described as standards in *Geography for Life.* However, the authors incorporated the application of geographic understanding into these content standards in two ways. First, two of the essential elements—*The World in Spatial Terms* and *The Uses of Geography*—describe the application of knowledge and understanding as content. For example, *The World in Spatial Terms* includes using maps and other geographic representations and technologies to report information from a spatial perspective; using mental maps to organize information about people, places, and environments in a spatial context; and analyzing the spatial organization of people, places, and environments on Earth's surface. *The Uses of Geography* element describes the application of geography to interpret the past and ways to apply geography to interpret the present and plan for the future. Second, for each content standard, the authors described what students should be able to do with that standard's content knowledge, implicitly reinforcing the importance of applying geographic knowledge.

Finally, *Geography for Life* helped to provide a well-rounded picture of modern geography by providing discussions of the nature of geographic inquiry and discussing why the study of geography is important. *Geography for Life* offered existential, ethical, intellectual, and practical reasons why individuals should learn geography, and the publication described how society benefits from having geographically informed citizens.

Like the *Guidelines for Geographic Education* a decade earlier, *Geography for Life* had a broad national impact on mainstream education. However *Geography for Life's* impact on classroom practice was largely indirect. Its direct impact was on educational policy. The publication's six essential elements were not as widely taken up by educators and curriculum developers as were the five themes. Even today, many textbooks and professional development programs still use the five themes as a central organizing scheme. On the other hand, *Geography for Life* has had an impact on educational policy that exceeds any other geography education document in the past 50 years. The release of *Geography for Life* provided impetus for all 50 states and the District of Columbia to establish state standards for geography, and it provided a model for them to follow. *Geography for Life's* content and structure were studied by the standards writers in every state, and its influence can be seen in nearly all of them.

As in previous documents, the balance between perspectives, skills, and knowledge that the authors of *Geography for Life* presented was not as influential as desired. Despite their prominence in *Geography for Life*, perspectives and skills are not nearly as well-represented in state standards as the content standards presented in the publication.

***Geography for Life: National Geography Standards,* Second Edition (2012).** In 2007, the members of GENIP decided it was necessary to revise the national geography standards to reflect changes in the discipline of geography and in the world. The second edition of *Geography for Life: National Geography Standards* (Heffron & Downs, 2012) maintained the spatial and ecological perspectives and the 18 content standards of geography, and it extended and elaborated on the geographic skills section. Reflecting an important change in the world since 1994, it incorporates geospatial technologies for problem-solving into many of the standards. The writing team also completely revised the concepts and performance expectations throughout the

content standards based, in part, on new research in the learning and cognitive sciences. The new descriptions use consistent language for cognitive activities drawn from research in the learning sciences, and they reflect new understanding of developmental learning across the K–12 continuum.

The new edition continues to advance the notion that geography education should be framed around core ideas, many of which are applicable to peoples' daily lives, as well as personal and community decision making and problem solving. This edition makes the case that being an informed citizen requires knowing the content of geography *and* being able to use geographic reasoning and skills.

Choosing a Destination: *Geography for Life*

After careful review and consideration, all three committees agreed that the second edition of *Geography for Life* should serve as the "destination" for the Road Map Project, because it meets all three of the criteria we had established for the goals of geography education:

- ***Reflect the essence of geography as defined by geographers:*** In its presentation of the content standards, *Geography for Life* reflects the central elements that geographers have identified with geography.
- ***Convey the qualities of geography that capture its distinctive benefits as a subject of study:*** In its depiction of the perspectives and skills and its process-oriented content standards, *Geography for Life* captures the four components of the geographic advantage.
- ***Focus on the portions of geography that have the greatest value for students and society:*** In its focus on the scientific aspects of geography with practical applications, *Geography for Life* focuses on the portion of geography that the committees believe is most valuable for students to learn.[2] While *Geography for Life* does not capture the full diversity or richness encompassed by modern geography, the committees think it captures the subset that will be most valuable for students' personal, professional, and civic lives.

Describing the Destination: Effectiveness and Balance

Across the history of efforts to reconceptualize geography education summarized above, there has been an ongoing struggle to promote the multi-faceted nature of geography as perspectives, skills, and content, which is contrary to a tendency in the educational system to focus more narrowly on content. The multi-faceted view of geography presented by the second edition of *Geography for Life* contrasts with the stereotypical view of geography as being about facts, in particular, the locations and names of places. While this stereotype could not be more inaccurate as a description of the field of geography, it is distressingly accurate as a description of the geography education that American students experience.

If it is successful, the Road Map Project will change this reality over the next decade by increasing the reach and effectiveness of efforts to improve geography education. Each of the committee goals is designed to address a critical implementation issue: the preparation of teachers, the nature of instructional materials, the design and structure of assessments, and the research base to inform educational decision making. However, the success of all of these efforts hinges on the ability of individuals to communicate about the true nature of geography, including the geographic advantage, to key stakeholders. For that reason, we extended our consideration of the goals of geography education beyond what they should be to how they should be *expressed*. In doing so, we identified two important issues to address: (1) the need to present a view of the different aspects of geography that is balanced and integrated; and (2) the need to clarify what it means to "do geography."

A Balanced and Integrated View of Geography

The stereotypical view of geography as fact-based and descriptive has proven persistent, no doubt because the stereotype corresponds to the experience of most American students and teachers for generations. In practice, this "understanding gap" functions as a source of resistance to any efforts to change geography education. Making a significant change to geography education will require a change in the understanding of geography by all stakeholders. Introducing new concepts of subject matter has proven to be a difficult challenge in the American educational system, but this is an occasion where the geography education community has the opportunity to learn from the experiences of other disciplines. For example, the backlashes that have confronted

[2] We characterize the geography presented by the second edition of Geography for Life as scientific because it employs methods of inquiry and standards of evidence that are associated with contemporary scientific practice. This subset of geography is sometimes referred to as the geographical sciences. By referring to this geography as scientific, we are describing its methods, not its content. Geography for Life reflects the consensus view of geographers that geography is concerned with both the social and physical worlds, and that it has a particular concern for the interactions between those worlds.

both math and science education reform efforts teach us how important it is to present reform as a process of integrating traditional and new approaches, rather than as a replacement of traditional with new.

For that reason, it is essential that we present a balanced view of geography that recognizes the importance of learning the place names, locations, and terminology that have characterized geography education historically, along with understanding powerful geographic concepts, and being able to reason geographically. We must be careful not to present the new conception as being a rejection or abandonment of what has been valued traditionally, but rather as an enhancement that establishes a better balance. This lesson applies not only to stakeholders that have been untouched by earlier reform efforts, but also to those who have invested in those reforms. For example, educators who have embraced the richer conception of content presented by *Geography for Life* and its precursors should see a focus on geographic reasoning as an enhancement to their efforts, rather than as a replacement of them.

To help stakeholders understand the value of this multifaceted geography (and to motivate them to support it), it is essential that we communicate the limitations of the traditional focus of geography education on its own and the value of the additional components for learners. It is essential that we do so in terms that are meaningful to stakeholders (e.g., "college and career readiness" is the discourse of educational policy as this report is being prepared, as well as preparation for personal and civic life).

For pedagogical purposes, it also is important that we communicate the importance of integrating the different facets of geography in education, rather than teaching them separately. Educational research teaches us that it is ineffective to separate learning of facts, concepts, and reasoning because they need to be used together in practice. However, a traditional view, and one that would feel more comfortable to many stakeholders, would be that factual understanding should be taught first, followed by conceptual understanding, and then reasoning skills.

Therefore, it is essential that we present a view of geography education that integrates learning of facts, concepts, skills, and reasoning at all levels from K to 12.

Geographic Practices

In reviewing the history of geography education reform, we see that the aspect of geography that has been taken up the least in schools is the application of geography understanding to answer questions or to solve problems. Where the articulation of the five themes in the *Guidelines* led to a broader understanding of geography content among the educators who were reached by it, historically there has been no comparable broadening in the understanding of the practices of geography.

As a result, all three committees have paid special attention in their work to the question of how to ensure that "thinking geographically" and "doing geography" become integrated into classroom practices in the next generation of geography education reform. Over the course of our work, we identified terminology as an issue. *Geography for Life* uses the term *skills* to describe the activities that constitute the doing of geography. However, concerns were raised by how well the term *skills* describe the complex, goal-directed behaviors that constitute geographic practice. In the course of our research, we found an alternative in the science and mathematics education literature—the word *practice* has been adopted in recent years as a term for these kinds of activities we were trying to capture. In that literature, the term *practice* is used to describe the behaviors that comprise scientific inquiry and problem-solving. A scientific practice is a goal-directed set of actions that contribute to a scientific inquiry or problem-solving process. Some of the scientific practices identified in the National Research Council's recent *Framework for K–12 Science Education* are asking questions, defining problems, developing and using models, constructing explanations, and engaging in argument from evidence (NRC, 2012, p. 49). Practices are shared across disciplines, but they typically are conducted in different ways across different disciplines (NRC, 2011). In this respect, discipline-specific practices encode the perspectives of the discipline.

Working from the skills described in *Geography for Life*, we identified six categories of geographic practice. Each of these categories represents an aspect of geographic inquiry or problem-solving, and encompasses specific practices that, either independently or in combination, can achieve a reasoning goal (Table 1). More detailed descriptions of the practices, along with examples representing how they are used by practicing geographers, ordinary people, and classroom instructors, can be found throughout the three Road Map Project committee reports.

Because it suited their goals better, the Geography Education Research Committee condensed these six categories into a smaller set. The Committee combined acquiring, organizing, and analyzing geographic information into a single category, and also combined

answering questions and designing solutions with communicating geographic information. Thus, the Committee's three categories are:

1. Formulating geographic questions;
2. Acquiring, organizing, and analyzing geographic information; and
3. Explaining and communicating geographic patterns and processes.

Mapping a Bright Future

In this chapter, we have presented an overview of the rationale and goals for the Road Map for 21st Century Geography Education Project. The project is motivated by a concern for the current state of geography education and the slow progress partners and others have made in improving it. By identifying promising strategies in key areas, we aim to mobilize and focus resources in ways that will increase the magnitude and pace of improvement. The remaining chapters in this report provide an analysis of key issues for geography education, and offer recommendations for how to focus improvement efforts during the coming decade. In doing so, this report joins the other Road Map Project reports in laying out a path toward the destination described in *Geography for Life*—an integrated geography education that balances learning of knowledge, understanding, and practices.

Table 1. Geographic Practices[3]

Categories	Practices
Posing geographic questions	a. Identify problems or questions that can be addressed using geographic principles, models, and data; express problems and questions in geographic terms.
Acquiring geographic information	a. Identify geographic data that can help to answer a question or solve a problem.
	b. Collect data (including observations and measurements) about geographic phenomena, and/or gather existing data to help answer a question or solve a problem.
Organizing geographic information	a. Organize data and create representations of data to help solve a problem or answer a question.
Analyzing geographic information	a. Identify data analysis strategies that can be used to help solve a problem or answer a question.
	b. Find and describe spatial and temporal patterns in data, or find data that matches a pattern, to help solve a problem or answer a question.
	c. Construct an explanation or prediction for phenomena by comparing data to a model or theory.
Answering questions and designing solutions	a. Construct an answer to a question or a solution to a problem using geographic principles, models, and data.
	b. Evaluate one or more answers to a question or solutions to a problem using geographic principles, models, and data.
Communicating geographic information	a. Inform or persuade an audience using geographic principles, models, and data.

[3] While the categories and practices are listed sequentially in the table following a widely used model of inquiry and problem-solving, we make no assumption that they will or should be conducted in that order in practice.

A Road Map for this Report

The Instructional Materials and Professional Development Committee developed this report with a focus on a vision of teaching and learning in geography, and with an emphasis on how the recommendations and guidelines in this report can support that vision. This report is structured into the following sections:

- **Context and Goals for the Road Map for 21st Century Geography Education Project:** The Preface and Chapter 1 are similar across all three reports in that they provide the general background of the Road Map Project, along with a discussion of geography, previous developments within the field of geography education, and a discussion of geographic practices.
- **A Vision of Teaching and Learning:** This section describes the Instructional Materials and Professional Development Committee's vision for teaching and learning in geography and discusses the Committee charge and process for developing the recommendations and guidelines that support this vision.
- **Recommendations and Guidelines:** This largest section of the report presents 10 recommendations for the design and evaluation of instructional materials and professional development in geography. The 10 recommendations are categorized into three broad groups: recommendations to support student learning, recommendations to support teacher learning, and recommendations to support large-scale collaboration and change.
- **Quick Reference Tables:** This section includes quick reference tables that provide a list of the recommendations and guidelines put forth in this report along with discussion questions that can be used as a dialogue tool.
- **Taking Action:** The final chapter of the report focuses on specific actions that individuals and groups can take to implement these recommendations. The actions are situated in the larger context of reform in geography education and are intended to provide specific examples or actions that can directly or indirectly improve instructional materials and professional development in geography.
- **Appendices:** A glossary, committee biographies, and references are provided in the appendices to frame our committee's expertise, the literature we read, and how we define key terms in the field.

Chapter 2: A Vision of Teaching and Learning in Geography

The study of geography has great potential to excite students' curiosity about the world and to enhance their experiences in it. Geographic knowledge can empower students and prepare them to make important contributions and decisions in a diverse, and increasingly complex, global society. Knowing geography allows students to better understand social and environmental issues within their own neighborhoods and on a global scale. For example, knowing geography gives students insight into the causes of conflict and cooperation around the world and it also provides students with a richer understanding of the interaction between the human and natural world. Furthermore, with innovations in geographic technologies and tools, interactive and hands-on instruction is more possible than ever, providing teachers and students with easy access to current geographic data, representations, and images that enrich learning experiences around geographic concepts. Information about places and events is readily available, along with virtual fieldtrips, web-based geographic information systems (GIS), and interactive mapping programs. However, students need to learn how to find, organize, analyze, and use this information with guidance from knowledgeable and skilled educators. Given the importance of informed decision making by citizens and the readily available geographic data and tools we have today to inform these decisions, this Committee puts forth a vision for teaching and learning of geography that takes advantage of these opportunities.

Imagine a classroom where...

...learning activities are engaging, student-centered, hands-on, and focused on student thinking and experiences with real-world issues;

...students investigate problems and solutions through fieldwork and geospatial technologies, such as web-based GIS and remotely sensed images;

...students learn how to collect, organize, and analyze geographic data to make decisions and actively participate in their local communities;

...students analyze maps, photographs, graphs, and charts to better understand patterns and distributions of geographic phenomena;

...students use their knowledge of geography to better understand other subject areas and to make informed decisions in their everyday lives; and

...a skilled and knowledgeable teacher, well-prepared and committed to teaching geography, guides the students in these activities.

Such a classroom gives students a taste of what geography *can* be, and provides learning experiences that go well beyond the traditional geography textbook and classroom walls. Our vision of geography education includes teachers who are well-prepared to teach geography, are passionate about supporting learning in the discipline, and are committed to their own learning of geography throughout their careers. It describes a classroom that promotes depth of learning, values students' prior knowledge and experience, and seeks to give students practice in *doing* geography. Geography can be a great equalizer. Every child has a "place" and knows something of the world around her or him. This common base of experience—place—is a core theme in geography, but it also is an important means of equalizing opportunity and legitimizing the experiences of children whatever their background. This kind of education we have described in our vision is one that prepares and inspires students to continue using geography as an important life skill. Achieving this vision is within our grasp; in fact, such classrooms do exist.

But sadly this vision is *not* what most students experience when learning geography. In most schools across the country learning geography is still focused on rote memorization of place names and terminology, allowing students to get by with superficial learning of the discipline and leaving them with a distorted image of what geography is about (Canestrari, 2005). Ironi-

cally, despite this lack of in-depth learning in schools, students are exposed to geography daily in their out-of-school experiences through computers, navigation units in cars, and applications on smart phones. They hear accounts of conflicts and peace negotiations around the world where geography has played a central role. Young people make choices every single day that have consequences on their local community's economy, and on the environment in which they live—choices that should be informed by geographic knowledge. While students undoubtedly have their own initial understandings of geography and use geographic tools on a regular basis, many have little awareness of how geography plays a role in their lives. Building knowledge in geography can enhance understanding in many aspects of students' lives—from world politics, economics and trade, and climate change, to land and resource use in their own communities. Knowing geography empowers students—tomorrow's leaders—to better understand and interact in our world.

Barriers to Achieving the Vision

If achieving this vision were easy, we would see more classrooms such as the one described above. Our description of good geography instruction can be daunting to teachers, especially given that few of them have had solid preparation in the discipline. Many teachers rely exclusively on geography textbooks not only to teach the subject to students, but also to learn it for themselves. Without skilled and committed teachers, students all too often receive poor, if any, instruction in geography. This situation is exacerbated by limitations on instructional time for geography and a reliance on instructional materials that promote rote memorization instead of effective learning and teaching practices. If we cannot provide high-quality instructional materials and professional development to teachers, it is inevitable that our vision for excellence in geography education will continue to be the exception to the rule.

Underprepared teachers. Geography is primarily taught by teachers with history, social studies, or elementary generalist certification, and many of these teachers have taken few, if any, geography courses in their general education or teacher preparation programs. These teachers must learn geography along with the students, relying heavily on textbooks for classroom instruction and reading just "one chapter ahead" of students (McDiarmid, Ball, & Anderson, 1989). This situation is not new to geography. Almost 90 years ago Charles Dryer (1924), then president of the Association of American Geographers, stated that "A large majority of the teachers have had no instruction in geography beyond that obtained from the text in hand, and have never come in contact with a teacher who knew much more of the subject" (p. 128). Many states require minimal, if any, geography coursework in teacher preparation programs, but we know that teacher content knowledge is extremely important to effectively teach the discipline to students (e.g., Shulman, 1986). Previous recommendations have been developed for preservice geography teacher requirements (Boehm, Brierley, & Sharma, 1994; GENIP, 2006); however, large-scale change in preservice geography teacher education has yet to occur. What we have seen in the past few decades is inservice professional development as the primary viable option for working with teachers. The majority of these programs have been spearheaded by the National Geographic Society's Network of Alliances for Geography Education (hereafter referred to as Alliance Network), but there have been only limited studies of the effectiveness of the Alliance professional development programs (e.g., Cole & Ormrod, 1995; Libbee, 2001; Mid-Continent Research on Education and Learning, 2000; Widener, 1996). Even given the efforts made by the Alliance Network and other professional development providers, most teachers remain ill prepared to teach geography and effectively implement the type of instruction we describe in our vision.

Uninspiring instructional materials. When teachers are ill prepared to teach geography, instructional materials become especially important in shaping the enacted geography curriculum. With little preparation in the discipline, teachers naturally turn to the resources provided to them to plan for instruction. Depending on the quality of these resources, effective geography instruction can be either supported or undermined. The instructional materials for K–12 geography largely consist of textbooks, atlases, and ancillary materials, such as student workbooks and teacher PowerPoint presentations. There are some video or multimedia resources available, as well as a growing number of lessons using geospatial technologies, such as GIS and remote sensing. With few exceptions, geography classrooms largely depend on textbooks and scaled-up instructional materials, sometimes described as the "mile-wide, inch-deep" approach to instruction (e.g., Schmidt et al., 1999), where teachers tend to use "lecture" to transmit geographic facts to students. Such a chapter by chapter, fact by fact approach to instruction is not only uninspiring, it is one with little chance of supporting students in achieving mastery in the discipline. Furthermore, most instructional materials are limited in the educative

features that support teacher knowledge and practice (Ball & Cohen, 1996).

The following example from *How People Learn* (Bransford, Brown, & Cocking, 1999) demonstrates how the learning of geography, when it is organized around powerful ideas, is far superior to coverage of factual knowledge often seen in classrooms today. The example shows how students who are taught only to memorize geographic facts are at a disadvantage in being able to use geographic information:

> A student can learn to fill in a map by memorizing states, cities, countries, etc., and can complete the task with a high level of accuracy. But if the boundaries are removed, the problem becomes much more difficult. There are no concepts supporting the student's information. An expert who understands that borders often developed because natural phenomena (like mountains or water bodies) separated people, and that large cities often arose in locations that allowed for trade (along rivers, large lakes, and at coastal ports) will easily outperform the novice. The more developed the conceptual understanding of the needs of cities and the resource base that drew people to them, the more meaningful the map becomes. Students can become more expert if the geographical information they are taught is placed in the appropriate conceptual framework. (p. 17)

The first description of learning in the example above—memorizing factual information and filling in a map—is a common approach to the teaching of geography, especially when using traditional geography instructional materials. Many geographers and geography educators have expressed concern about such an approach, warning that this mode of teaching reduces geography to an "encyclopedic" discipline, where geographic knowledge is nothing more than the recitation of capitals, states, and countries. While maps are important tools for learning geography, as they represent complex geographic concepts (e.g., location, spatial patterns of phenomena, boundaries, movement of people and goods, etc.), instructional materials must move beyond activities that require students to only label maps. The materials should pose situations that engage students in geographic practices (e.g., asking geographic questions, analyzing geographic data, and so on).

Moving Forward

Despite the barriers previously discussed, we believe that change is possible through high-quality instructional materials and professional development. Guskey (2002) stated, "High quality professional development is a central component in nearly every modern proposal for improving education…schools can do no better than the teachers and administrators who work within them" (p. 381). Improving the quality of professional development is an important step toward building a cadre of prepared and committed educators in geography. Such professional development should be guided by the belief that teachers are not only recipients of professional development; they also are key collaborators in achieving the vision for excellent geography education. Preparing teachers with a high capacity to teach within the discipline, and a positive disposition toward geography education, can lead to more fruitful conversations about how instructional materials can best support geographic learning among students.

Committee Charge

The Instructional Materials and Professional Development Committee reviewed education research from the past 25 years on instructional materials and teacher education in order to create recommendations and guidelines for the design of materials and professional development to support teaching and learning in geography. The work of the Instructional Materials and Professional Development Committee was guided by the following questions:

- How can students best learn geographic big ideas and practices?
- What are attributes of effective teaching of geography?
- How can instructional materials and professional development be designed to support effective and equitable teaching and learning practices in geography?

The goal of the Committee was to create research-based recommendations and guidelines to support the key knowledge, practices, and dispositions that students and educators must possess; strategies for supporting the professional development of educators; and the design and evaluation of engaging and effective instructional materials in geography. Developers, educators, funders, and policy makers can use the recommendations and guidelines to assist them in designing, sharing, and implementing research-based instructional materials and professional development programs that support effective teaching and learning in geography.

Committee Process

In developing this report, the Committee thought deeply about the supports necessary to achieve progress

toward our vision of excellence in geography education. Based on a thorough review of the literature, we developed a set of 10 recommendations we believe are necessary for promoting improvement in instructional materials and professional development in geography. These recommendations are based on the research on student learning and effective teaching practice. We focused on teachers as the cornerstone for improving student learning in geography, and we targeted our recommendations to various groups that provide support to teachers: curriculum developers, teacher educators, professional development providers, and policy makers.

Importantly, these recommendations are intended to be forward-looking with the potential to transform teaching and learning in geography. They are not premised on current practice. We developed recommendations to promote ideal geography instruction; these are recommendations we believe can realistically guide improvements in geography instruction in schools where geography is taught well, taught on the fringes, or where geography needs to be introduced into the curriculum.

Early in the committee process, we wrestled with two major issues: (1) the integration of instructional materials and professional development, and (2) geography's place in the K–12 curriculum. As a committee, we first had to decide whether we would develop recommendations and guidelines that supported an integrated view of instructional materials and professional development, or treat them as separate from one another (Assertion 1). Secondly, we had to decide whether the recommendations and guidelines would support geography as a stand-alone or integrated subject (Assertion 2). After much discussion, we came to consensus on these two issues, and the assertions below guided our remaining work.

The Committee initially met in January 2011, at the National Geographic Society in Washington, DC, to assess the committee task and chart a course for the committee work. The Committee consisted of 15 members with expertise in geography and education, including teachers, professional development providers, curriculum developers, school administrators, geographers, and education researchers (see Appendix B). Subsequent meetings were held in June and September 2011, and in January and May 2012, to develop recommenda-

Assertion 1: Instructional materials and professional development must be integrated to achieve the best results.

Our Committee strongly believes that professional development should not occur in absence of the instructional materials used by the teacher, and likewise, instructional materials should not be used without any professional development. By integrating the two, teachers can gain a much better understanding of how to use and adapt the materials at hand to respond to dynamic classrooms with diverse students. Furthermore, professional development that seeks to help teachers better understand instructional materials and teaching practice in the actual classroom is a more authentic learning experience for the teacher, and likely to have greater impact on their teaching.

Assertion 2: Geography should be taught wherever it is found.

We recognize the constraints to teaching geography in today's classrooms. Instructional time is limited for many school subjects, but geography is arguably one of the most neglected subjects in the curriculum. Unfortunately, instructional time is allotted based on the standards and assessments currently emphasized in the educational system. This means that geography receives little attention in the elementary classroom because math and literacy dominate the curriculum and, in middle and high school, we find that while many traditional science and social science disciplines are required (e.g., biology, chemistry, history, civics), geography typically is not required. Geography instruction in most schools is limited, inconsistent, and occurs intermittently, often integrated into the teaching of other subjects. As such, we developed recommendations that can support the teaching of geography wherever it is found in the curriculum, even when geography does not appear as a stand-alone subject. Moreover, we recognize that the recommendations in this report can hold true for many subject areas. They are intentionally written to apply in a variety of educational contexts, from the general education elementary teacher to the middle school earth science teacher to the secondary stand-alone geography teacher. When possible, we included geography-specific guidelines for instructional materials and professional development, but often relied on generally accepted best practices, regardless of the subject matter being taught. As such, many teachers who find themselves teaching geography in an integrated curriculum can utilize these recommendations throughout their teaching.

tions and guidelines for the design, implementation, and evaluation of instructional materials and professional development. The Committee consulted experts in geography and education throughout the process in four ways: (1) hosting a workshop at the June 2011 meeting with experts in geography and education; (2) hosting a webinar series with experts in online education and geospatial technology; (3) conducting an extensive review of the literature to prepare a research synthesis; and (4) conducting focus groups with teachers, administrators, and developers to gather feedback on proposed guidelines for instructional materials and professional development. The Committee solicited feedback on the report findings through an internal, invited review, an external public review, and a panel session at the Annual Meeting of the Association of American Geographers. Final revisions were made by the Committee in May 2012, and the report was then submitted to the National Geographic Society in August 2012.

Chapter 3: Recommendations and Guidelines

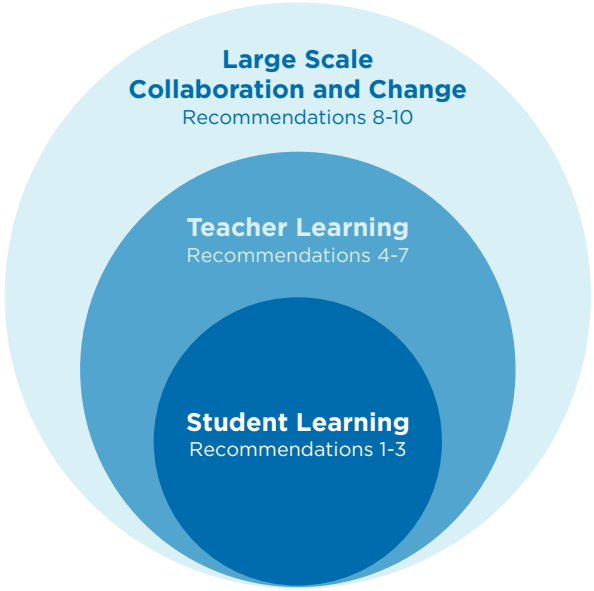
Developing the Recommendations

The recommendations developed by this Committee are situated in three categories: (1) recommendations to support student learning, (2) recommendations to support teacher learning, and (3) recommendations to support large-scale collaboration and change. At the core of instructional materials and professional development should be student and teacher learning; thus, seven of our recommendations provide support for these two categories. However, we recognize that funding and research, collaboration, and the development of tools also are urgently needed to improve geography education. Therefore, the final three recommendations focus on large-scale collaboration and change.

Recommendations to Support Student Learning

The recommendations to support student learning focus on the design and use of instructional materials in K–12 classrooms. We recognize that instructional materials support student learning directly. They also influence teaching practices, and as such, the developers of instructional materials must be thoughtful about how to convey the big ideas and practices of geography in effective and engaging ways to students. Furthermore, developers must consider how teachers will use the materials in the classroom, and how materials will support the curriculum that teachers must cover. The three recommendations to support student learning include:

- teaching geography's big ideas and practices (the "what" of instructional materials),
- attending to student thinking (considering "who" will engage with materials), and
- effective teaching practices in geography ("how" best to convey content).



Recommendations to Support Teacher Learning

The recommendations to support teacher learning address the professional development continuum of teachers from preservice through inservice education. We recognize that professional learning should be supported throughout a teacher's career, and can be fostered by both professional development programs and instructional materials. Thus, the recommendations to support teacher learning include:

- instructional materials that intentionally support teacher learning,
- professional development that focuses on teachers' content knowledge and pedagogical content knowledge,
- professional development that promotes the professional growth of teachers, both as individuals and as a community of learners, and
- preservice programs that provide teachers with a solid preparation in teaching geography.

Recommendations to Support Large-Scale Collaboration and Change

The final three recommendations are meant as a clear call for action among developers, educators, and policy makers to improve teaching and learning of geography on a large scale. To do so, we need strategic research and funding sources, collaboration among various invested groups, and tools to assist in the design and delivery of materials and professional development, all of which are needed to advance our vision for excellence in geography education. These three recommendations call for:

- strategic research on instructional materials and professional development in geography that can secure steady sources of funding,
- collaboration among various stakeholders who have a direct or indirect role in teacher and student learning of geography, and
- development of tools for designing, evaluating, and implementing instructional materials and professional development programs.

Key Features of the Report

Each of the 10 recommendations made in this report is organized so that developers, educators, and policy makers can easily find the information most relevant to their work.

Each recommendation is organized to include the following:

- a core argument supporting the recommendation, with guidelines for implementation of the recommendation and a list of recommended readings,
- a summary of research that supports the recommendation with recommended research readings,
- a "Geography in Practice" vignette that illustrates a real example of the recommendation in practice, and
- special topic boxes that provide more information on key ideas or terms described in the recommendation.

Following Chapter 3 are quick reference tables which include each recommendation, corresponding guidelines, and discussion questions.

RECOMMENDATION SNAPSHOT

To support student learning in geography...

Recommendation 1:
Focus instructional materials on big ideas and practices of contemporary geography across subjects and grade levels.

Recommendation 2:
Design instructional materials that build upon students' prior geographic knowledge and experience and challenge students' thinking.

Recommendation 3:
Develop instructional materials that use teaching strategies to engage all learners in meaningful explorations of geography.

To support teacher learning in geography...

Recommendation 4:
Design instructional materials to be learning tools for teachers.

Recommendation 5:
Develop and implement professional development programs that enrich teachers' knowledge of contemporary geography and how to teach it.

Recommendation 6:
Design and implement coherent and sustained professional development programs with clear and measurable goals.

Recommendation 7:
Enhance preservice teacher education programs to emphasize teaching geography across subjects and grade levels.

To support large-scale collaboration and change...

Recommendation 8:
Develop and fund extensive research and evaluation in geography instructional materials and professional development.

Recommendation 9:
Create opportunities for sustained and authentic collaboration among geographers, education researchers, and practitioners.

Recommendation 10:
Design and disseminate tools and exemplars to inspire and support educators, developers, and policy makers in leading the implementation of these recommendations.

Photos courtesy of (from left to right): Teachers' Curriculum Institute (TCI), Oregon Geographic Alliance, and STEMworks™

Big Ideas and Practices in Geography

Recommendation 1: Focus instructional materials on big ideas and practices of contemporary geography across subjects and grade levels.

Contemporary geography is about the study of the distribution, patterns, and processes that shape the physical and human landscapes of Earth and, in particular, the interactions between people and the environment. While one geographer might study the dispersion and influence of religion or languages around the world, another might investigate changes in water flow and quality as a result of agricultural or urban development. Though the study of geography is diverse, at the heart of geographic work are fundamental principles and practices that serve as a geographic lens on the world. The geographic lens, as described in *Geography for Life,* gives students the ability to "acquire and use spatial and ecological perspectives to develop an informed worldview" (Heffron & Downs, 2012, p. 13). Important to developing a geographic lens is the understanding that human and physical phenomena have complex interactions that are spatially distributed and can be observed and analyzed at varying scales.

Many of the instructional materials currently available in geography education, however, provide little support to help students acquire this geographic lens. These materials can unintentionally communicate to students that geography is simply factual knowledge to be learned and memorized in school. Students learn about the products of geographic work—the theories, definitions, and information already acquired by professional geographers—but there is very little about the core principles that guide geographic work, or the processes by which geographic knowledge is developed (Hill, 1995; Valverde & Schmidt, 1997).

Designing classroom resources to help teachers make day-to-day and week-to-week instructional decisions is complicated. Instructional materials are one of the primary resources teachers turn to when making these decisions. Sometimes the big ideas (i.e., fundamental principles, concepts, and themes) and geographic practices are not well developed in the instructional materials and the result is a series of learning activities that steadily march through the content with little overall progress toward building cohesive geographic literacy among students. In a study of science instructional programs, Kesidou and Roseman (2002) found that "although most key ideas were present in the programs, they were often buried between detailed, conceptually difficult, or even unrelated ideas, making it difficult for students to focus on the main ideas" (p. 527). Making big ideas and practices salient in instructional materials is a necessary step toward promoting rich learning of geography over superficial memorization.

Our Committee recommends the following guidelines to support the design and implementation of instructional materials around big ideas and practices:

- **Big Ideas and Practices That Connect Learning Over Time.** Instructional materials should focus on big ideas and practices of geography that make connections across learning experiences.
- **Thinking Geographically.** Instructional materials should illustrate how geographers "think" about questions and problems, providing students with models for "thinking geographically" and creating opportunities for students to practice this type of thinking.
- **Strategic and Purposeful Learning Experiences.** Instructional materials should convey a sense of purpose for learning big ideas and practices, and they should include a strategic sequencing of learning experiences.
- **Accurate Content That Presents Multiple Perspectives.** Instructional materials should include geographically accurate content that honors diverse perspectives.

Big Ideas and Practices That Connect Learning over Time

As Gregg and Leinhardt (1994) explain, "A student of geography is meant to be less an encyclopedia of information than a discoverer of geographic relations" (p. 314). Our Committee argues that instructional materials developers need to make a concerted effort not to "lose the forest for all the trees"—that is, geographic big ideas and practices should not be lost in materials

Big Ideas and Practices in Geography

The Committee adopted the terms big ideas and geographic practices to describe the *what* of geographic study. We recognize there are other terms used in similar ways, such as "content and skills" or "principles and processes." *Geography for Life* uses "enduring understandings" and "skills." Similar to enduring understandings, we chose the term "big ideas" to represent core ideas, concepts, and principles of the discipline because they have broad explanatory power over diverse geographic phenomena. We chose the term "practices" because we believe that it is more inclusive of *doing geography,* as opposed to simply having a set of skills. When we use the term "practice" we are referring to the geographic practices outlined in Chapter 1 of this report.

that emphasize memorizing place names, definitions, and other geography facts. *Geography for Life* is an important starting point for determining and using big ideas and practices in instructional design. These standards outline learning goals for students at different grade bands. As the standards are unpacked to produce instructional materials, developers need to use the big ideas and practices as the "backbone" of the curriculum to connect learning activities across the school year.

Examples of big ideas in geography that can provide coherence for instructional materials are provided below. This list includes example big ideas that have broad explanatory power in geography, and all are based on the standards in *Geography for Life* (see Table 2 for complete listing of the geography standards[4]):

- Maps and other representations communicate spatial information about people, places, and environments at various scales.
- There are advantages and disadvantages of location.
- Push and pull factors influence movement of people.
- Physical systems affect people.
- Humans modify the environment, and this has consequences.

Curriculum developers and educators should question how well big ideas are addressed in the instructional materials they design or use. For example, are big ideas used to organize content across the year, or are they addressed only in a single lesson or short unit? Do the instructional materials include activities where students explicitly discuss the big idea, and additional activities where they return to these discussions? Given the amount of instructional time allotted to making sense of the big idea, what would be reasonable expectations for student learning? Collaborative dialogue around these questions can help developers and educators better understand the depth at which big ideas are explored in the materials and identify ways to improve materials when necessary.

Migration streams around the world. Image courtesy of Teachers' Curriculum Institute

In addition to making big ideas more central in instructional materials, our Committee also argues that geographic practices should play a more significant role in learning geography. The categories of geographic practices supported in this Road Map Project report include:

- posing geographic questions,
- acquiring geographic information,
- organizing geographic information,
- analyzing geographic information,
- answering questions and designing solutions, and
- communicating geographic information.[5]

With the release of *Geography for Life,* it is hoped that geographic practices will be more fully integrated with content as often as possible. The inclusion of geographic

[4] We have not elaborated on the big ideas of geography in this report, as this work is covered in detail in Geography for Life (Heffron & Downs, 2012). We strongly encourage readers to become familiar with the 18 national geography standards, as this is representative of the core content of geography. In writing this report, we have assumed that readers are (or will become) familiar with this document.

[5] The Geographic Practices are discussed in Chapter 1 and are covered in length by the Assessment Committee Report (Edelson, Shavelson, & Wertheim, 2012).

practices in instructional materials does not mean simply adding activities to existing materials where students learn practices in isolation from content. Rather, geographic practices should be integrated with the learning of big ideas. This integration creates rich learning experiences for students, as illustrated in the following example: Imagine that students are learning about their community's development patterns (*Geography for Life,* Standard 12: The processes, patterns, and functions of human settlement). They pose the geographic question, "Why are the old factories located on the south side of town while the nice neighborhoods are on the north side?" To answer this question, students collect and organize census data, contemporary and historic maps, and information about access to local natural resources. When analyzing the data, students discover that many factories originally were built near water sources, downstream of the residential areas because homeowners desired more pristine views and clean waters found upstream from the factories. This type of learning experience not only enhances students' awareness of historical development patterns in their community, but also provides the experience of asking questions that can be answered through careful analysis of geographic information.

Thinking Geographically

The ways of thinking used by geographers can be markedly different from students' everyday ways of thinking. Young children tend to understand and explain the world through informal narratives and stories (e.g., Pinker, 2007), which often do not include the analytic forms of reasoning that help geographers explain the world (Brophy & Alleman, 2006). Geographic thinking may be unfamiliar to many students. Developers

Table 2. National Geography Standards

***Geography for Life: National Geography Standards,* Second Edition**	
The World in Spatial Terms	1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information 2. How to use mental maps to organize information about people, places, and environments in a spatial context 3. How to analyze the spatial organization of people, places, and environments on earth's surface
Places and Regions	4. The physical and human characteristics of places 5. That people create regions to interpret earth's complexity 6. How culture and experience influence people's perceptions of places and regions
Physical Systems	7. The physical processes that shape the patterns of earth's surface 8. The characteristics and spatial distribution of ecosystems and biomes on earth's surface
Human Systems	9. The characteristics, distribution, and migration of human populations on earth's surface 10. The characteristics, distribution, and complexity of earth's cultural mosaics 11. The patterns and networks of economic interdependence on earth's surface 12. The processes, patterns, and functions of human settlement 13. How the forces of cooperation and conflict among people influence the division and control of earth's surface
Environment and Society	14. How human actions modify the physical environment 15. How physical systems affect human systems 16. The changes that occur in the meaning, use, distribution, and importance of resources
The Uses of Geography	17. How to apply geography to interpret the past 18. How to apply geography to interpret the present and plan for the future

Source: Heffron and Downs (2012)

of instructional materials need to be aware of these differences and create scaffolded learning experiences that provide rich opportunities for students to observe and practice geographic thinking.

To provide support for geographic thinking, instructional materials may include examples of how geographers investigate and explain phenomena, and how geographers use geographic reasoning to make decisions. In addition to providing models of geographic thinking, students also need opportunities to practice through classroom activities. For example, students might complete a unit on run-off in urban developments, asking questions about major sources of pollution and how engineered water systems carry this run-off through urban landscapes (*Geography for Life*, Standard 14: How human actions modify the physical environment). They might examine data on sources of pollution and interpret visualizations and maps of the urban landscape and water system. Furthering geographic thinking, the students might *apply* this new knowledge to their own community, and determine local sources of pollution, how the water is diverted in their own landscape, and any local consequences downstream resulting from how the water system is engineered. Throughout this process, students could encounter examples of geographers studying these issues, with explanations of how the geographers use the data they collect.

Strategic and Purposeful Learning Experiences

The geographic lens is not something that can be taught in a single unit, or even in a single school year. It is acquired over years of study in the discipline. With this in mind, it is especially important that instructional materials assist teachers in situating geography instruction within the larger picture of learning, especially as geography connects to other science and social science subjects. Instructional materials are critically important resources for helping both teachers and students understand how learning experiences are connected across time. Many instructional materials already include temporal aides for teachers, such as weekly planners and monthly or annual pacing calendars. However, these tools primarily focus on timelines for pacing content, and typically provide little assistance to help teachers make connections across lessons or units around the big ideas and practices of the discipline. If instructional materials are to support deep geographic learning, developers need to give thoughtful attention to the sequencing of instructional activities around big ideas and practices across the year (or several years), with the prominent role of big ideas and practices made explicit through teacher-friendly supports and tools.

Even within a single geography unit, instructional materials need to provide an explicit rationale to teachers about why students are engaging in certain activities in a particular sequence. This not only justifies the importance of each activity, but also the connection of each activity to what comes before and after. Strategic sequencing can build connections within a single unit, making the purpose of each activity visible to both teachers and students. The same is true for building connections across units of study during the school year, such that a big idea explored early in the school year (e.g., advantage and disadvantage of location) can be leveraged as students study another big idea later in the year (e.g., the push and pull factors that influence the movement of people).

Accurate Content That Presents Multiple Perspectives

Another essential component of high-quality instructional materials in geography is factually accurate content that also recognizes that geographic events and processes may be understood from different perspectives. Accuracy of content is critical, but this does not mean that geographic questions always have a single "right" answer. Traditional instructional materials tend to funnel students toward finding an answer, but looking for single right answers can shortchange the critical thinking processes important in geographic work. As geography is so deeply embedded in human cultures and societies, perceptions of how and why change occurs will be different depending on one's viewpoint. Instructional materials should include these multiple perspectives, when appropriate, to allow students to have the opportunity to look at the world from different points of view.

Conclusions

While changing our approach to geography instruction will take time, we need to begin a dialogue on how new instructional materials can capture the spirit of geography as laid out by *Geography for Life* and this report. We argue that the geography education of our future will need to foster an appreciation for powerful ideas in geography among youth, and encourage all students to use a geographic lens to understand and explore their world. We believe that given thoughtful and sustained instruction in geography over many years of schooling, students leaving high school and college will have a solid foundation of global knowledge that is readily accessible and usable in their lives. Acquiring this level of understanding demands an approach to

instructional material design that moves away from teaching geography as a fact-based discipline and toward the development of materials that create rich learning experiences around the big ideas and practices in geography.

Recommended Reading

Heffron, S. G., & Downs, R. M. (Eds.). (2012). *Geography for life: National geography standards* (2nd ed.). Washington, DC: National Council for Geographic Education.

Erickson, H. L. (2002). *Concept-based curriculum and instruction: Teaching beyond the facts.* Thousand Oaks, CA: Corwin Press.

Common Core Connection

Geography's "big ideas" are spelled out clearly in the 18 standards and six essential elements in *Geography for Life*. However, beyond knowing these big ideas of geography, students also must become critical consumers of information who can apply their knowledge effectively and productively in personal, career, and civic life. The *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Sciences, and Technical Subjects* (2010) puts forth characteristics of a college- and career-ready student as one who can:

> (1) demonstrate independence; (2) build strong content knowledge; (3) respond to the varying demands of audience, task, purpose, and discipline; (4) comprehend as well as critique; (5) value evidence; (6) use technology and digital media strategically and capably; and (7) come to understand other perspectives and cultures. (p. 7)

What would integrating these Common Core standards look like in an actual geography classroom? The following is one example of how an Advanced Placement Human Geography (APHG) teacher approached this integration. After attending a workshop about the APHG course at the National Conference for Geographic Education, high school teacher Julie Wakefield became committed to finding a way to foster her students' awareness and appreciation of the Common Core standards of valuing evidence and multiple perspectives. She also wanted them to simultaneously develop their research and writing skills. After reflecting on various suggestions offered at the workshop, Ms. Wakefield developed an assignment that placed students in small groups to conduct a research project on a topic featured in the College Board's APHG content outline (e.g., population, culture, political organization, agriculture, economic development, or cities and urban growth). To complete the assignment, students were required to:

- develop a research question to guide their work;
- narrow their inquiry where appropriate;
- synthesize a variety of multiple sources on the subject;
- evaluate authors' differing points of view on the same concept or topic;
- integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually and quantitatively as well as in words); and
- demonstrate an understanding of their findings in writing and speaking at the conclusion of the project.

After the collaborative research projects were complete, Ms. Wakefield observed that her students had gained a greater capacity to:

> (1) work with other students who had different perceptions, approaches, and opinions than their own; and (2) value the visual and text-based evidence available on the same topic in print and on the web and make appropriate choices to support their findings as a group.

This literacy-based geography assignment not only encouraged AP students to develop the college- and career-ready characteristics outlined in the Common Core standards, it also provided the students with a greater understanding of geographic big ideas.

Research on Learning Big Ideas

In their report to the National Research Council, Bransford, Brown, and Cocking (1999) argue that people learn best when instruction occurs around a meaningful exploration into important ideas in the discipline. A novice learner does not build expertise in a discipline by memorizing many, many facts. Instead, the novice learner ultimately masters the discipline because the learner changes his or her thinking in fundamental ways. Meaningful learning occurs when novice learners come to understand the usefulness of organizing knowledge around big ideas and can use the big ideas to help make sense of new situations. They now understand and "see" the world in different ways.

A solid body of research on building expertise shows a stark contrast between the way experts and novices learn and think in the discipline (e.g., Brewer & Samarapungavan, 1991; Brown, 1990; Chi, Feltovich, & Glaser, 1981; deGroot, 1965). This research shows that the knowledge of experts is not only better organized, but also is more readily accessible when it is needed. Experts can identify relevant information in a novel situation, activate the knowledge or skills they need to explore the new information, and they can store what they learn in meaningful chunks (schema). For example, more advanced map-readers have the advantage of being able to chunk visual data on maps for meaningful interpretation (Anderson & Leinhardt, 2002; Chase & Ericsson, 1982). Novices, on the other hand, have not yet learned what is meaningful and tend to focus on easily memorized factual information that appears relevant to them. The differences between experts and novices have been noted in many disciplines, from chess to sciences to systems thinking (e.g., Carey, 1988; Chi et al., 1981; Hmelo-Silver & Pfeffer, 2004; Hmelo-Silver, Marathe, & Lui, 2007). One clear illustration of the expert-novice difference was shared in a study by Wineburg (1991), as described by Bransford et al. (1999):

> A group of history experts and a group of gifted, high-achieving high school seniors enrolled in an advanced placement course in history were first given a test of facts about the American Revolution. The historians with backgrounds in American history knew most of the items. However, many of the historians had specialties that lay elsewhere and they knew only one-third of the facts on the tests. Several of the students outscored several of the historians on the factual test. The study then compared how the historians and students made sense of historical documents; the result revealed dramatic differences on virtually any criterion. The historians excelled in the elaborateness of understandings they developed in their ability to pose alternative explanations for events and in their use of corroborating evidence. This depth of understanding was as true for the Asian specialists and the medievalists as it was for the Americanists. When the two groups were asked to select one of three pictures that best reflect their understanding of the battle of Lexington, historians and students displayed the greatest differences. Historians carefully navigated back and forth between the corpus of written documents and the three images of the battlefield. For them, the picture selection task was the quintessential epistemological exercise, a task that explored the limits of historical knowledge. They knew that no single document or picture could tell the story of history; hence, they thought very hard about their choices. In contrast, the students generally just looked at the pictures and made a selection without regard or qualification. For students, the process was similar to finding the correct answer on a multiple-choice test. In sum, although the students scored very well on facts about history, they were largely unacquainted with modes of inquiry with real historical thinking. They had no systematic way of making sense of contradictory claims. Thrust into a set of historical documents that demanded that they sort out competing claims and formulate a reasoned interpretation, the students, on the whole, were stymied. They lacked the experts' deep understanding of how to formulate reasoned interpretations of sets of historical documents. (pp. 38, 41–42)

The study by Wineburg (1991) leads us to question what we are preparing students to do with historical information. Do we want students to simply master a test of factual knowledge, or do we want them to be critical consumers of historical information? Some students seem to excel in the memorization of factual information to "master school." Others completely tune out. Just as in history, geography classrooms frequently emphasize

learning facts rather than grappling with big ideas, and this is shortchanging students—both the high-achieving memorizers and the tuned-out strugglers.

Instructional materials play an important role in creating this atmosphere. In one study that compared the science curriculum in the United States to the curriculum in high-performing countries around the world (as measured by international science assessments), researchers found that the U.S. curriculum, especially textbooks, were the extreme example of superficial coverage of topics, giving little instructional time and depth to core topics (Valverde & Schmidt, 1997). Few connections were made across topics using disciplinary themes. Like science textbooks, far too many geography textbooks tend to focus on disconnected information and geography facts, with very little coverage of the process of "doing geography" (Hill, 1995). Even when important ideas are included in instructional materials, research has found the big ideas often are buried under less important details (Kesidou & Roseman, 2002). These studies send an important message to curriculum developers and users who will need to be more attentive in the coming years to how well instructional materials address big ideas and practices in geography, and support goals for geographic literacy.

Recommended Research Reading

Bransford, J. D., Brown, A. L. & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

Gregg, M., & Leinhardt, G. (1994). Mapping out geography: An example of epistemology and education. *Review of Educational Research, 64*(2), 311–361.

Hmelo-Silver, C. E., & Pfeffer, M. G. (2004). Comparing expert and novice understanding of a complex system from the perspective of structures, behaviors, and functions. *Cognitive Science, 28*(1), 127–138.

Hmelo-Silver, C. E., Marathe, S., & Liu, L. (2007). Fish swim, rocks sit, lungs breathe: Expert-novice understanding of complex systems. *Journal of the Learning Sciences, 16*(3), 307–331.

Geography in Practice

Teaching Big Ideas and Practices of Geography

The following case study focuses on how Fred Walk, a former geography teacher at Normal Community High School in Normal, Illinois, engaged his students by presenting powerful geographic concepts for students to understand the world around them. This case study focuses on a unit he taught about spatial inequality in Mexico City. The essential question is: Why does spatial inequality exist in urban areas? Ultimately, students take what they learn in the Mexico City case study and apply it to understanding spatial inequality on both a regional and a global scale.

Mr. Walk's students file into class on a Monday morning talking about sports, music, and their social lives. They have no idea that their assumptions about what it means to live a "normal" lifestyle are about to be turned upside down.

Mr. Walk begins class by projecting an image of a desperately poor home on the outskirts of Mexico City and asking a series of questions: "What do you see? What building materials is this home made of? Who lives here? Do you think they have running water or electricity? Why do people live like this?" His students immediately begin giving answers. Some even leave their seats and approach the projected image in order to point out details such as an abandoned baby stroller on the roof and a burned-out trash can in front of the family's home.

Next, Mr. Walk projects an image of a wealthy home in Mexico City and asks a similar set of questions: "What do you see? How is this house made? Who lives here? Why do people live like this?" His questions elicit a series of very different answers from the first image. Soon, students are asking: Why is there such a contrast between rich and poor in Mexico City? How did this happen? Is it fair? Should something be done about it? If so, who should do it? "That's when I know students are ready for learning," says Mr. Walk. "When they begin asking questions like geographers, I've got them hooked."

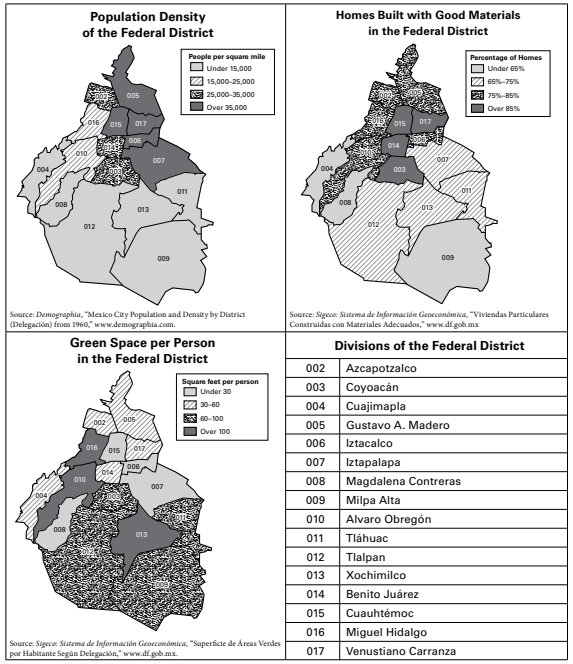
Mr. Walk's classroom exemplifies the first recommendation by:

- focusing on a big idea (spatial inequality), and
- integrating geographic practices (e.g., analyzing geography data).

STUDENT HANDOUT

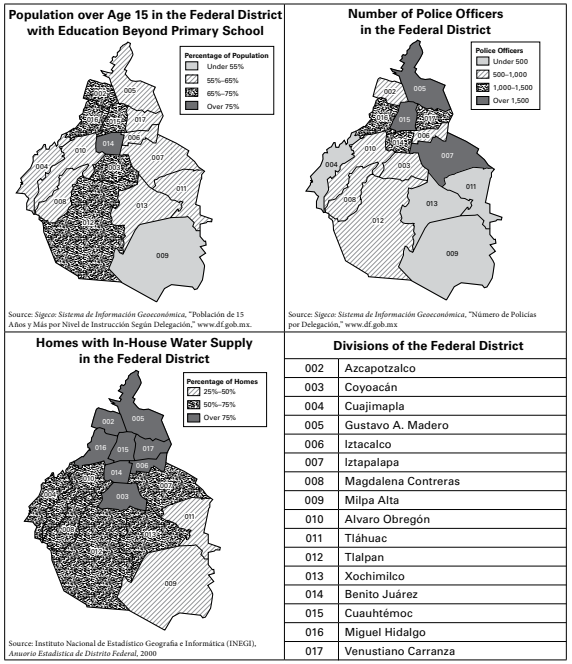
Information on the Federal District

Use these maps to help you complete Part 3 of your Reading Notes.



Divisions of the Federal District	
002	Azcapotzalco
003	Coyoacán
004	Cuajimapla
005	Gustavo A. Madero
006	Iztacalco
007	Iztapalapa
008	Magdalena Contreras
009	Milpa Alta
010	Alvaro Obregón
011	Tláhuac
012	Tlalpan
013	Xochimilco
014	Benito Juárez
015	Cuauhtémoc
016	Miguel Hidalgo
017	Venustiano Carranza

STUDENT HANDOUT



Divisions of the Federal District	
002	Azcapotzalco
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006	Iztacalco
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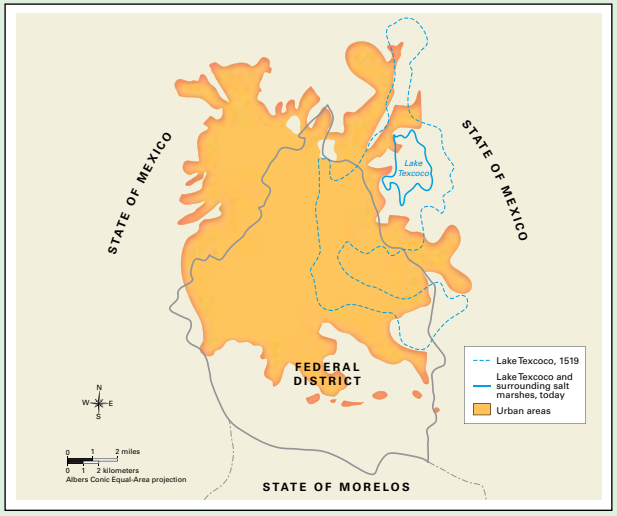
012	Tlalpan
013	Xochimilco
014	Benito Juárez
015	Cuauhtémoc
016	Miguel Hidalgo
017	Venustiano Carranza

Activity using chloropleth maps of Mexico City showing key demographic data by neighborhood. Image courtesy of Teachers' Curriculum Institute

Mr. Walk now projects a graphic organizer that shows regions in Mexico City and photographs of three neighborhoods: impoverished, middle class, and upper class. He uses the same strategy of asking spiraled questions from the basic to the more complex: "What do you see? What might the map represent? What do you think the photographs represent? How do the photographs correspond to the map?" Mr. Walk's students eagerly try to interpret the Mexico City map and finally conclude that the map represents how different economic groups are distributed throughout Mexico City. "My students now really want to know about spatial inequality and are primed to begin looking at demographic data about the neighborhoods of Mexico City," said Mr. Walk.

To gather data, students are told they will "visit" four different neighborhoods in Mexico City to learn about the city's growth as an urban center and to investigate the spatial inequalities that exist there. Working in pairs, they "ride in a taxi" (two desks pushed together) to each neighborhood. Once there, they leave their "taxi" and stand in front of a projected image of a resident in the neighborhood and listen to a recorded interview about life there. They must listen very intently, because during the interview each resident gives them demographic clues as to which neighborhood they are in. For example, in the first neighborhood, Rosa Muñoz is interviewed. She tells her interviewers that she moved from a farm in southern Mexico and now lives in this urban neighborhood that has few trees and little grass, and where most residents did not go past primary school. "My students listen very carefully for those key demographic data," Mr. Walk explains. "They will be using the data to analyze six choropleth maps showing



Mexico City and the Federal District. Image courtesy of Teachers' Curriculum Institute

the sixteen municipal divisions of Mexico City."

When the interview concludes, students return to their "taxis" to answer a series of questions about their visit and to try to pinpoint which of Mexico City's sixteen municipal neighborhoods they just visited. They have a series of six choropleth maps of Mexico City, each showing key demographic data such as population density, green space per person, and population over age 15 attending school beyond the primary grades, for each of the city's sixteen neighborhoods. They must find the neighborhood that fits all the demographic data. This entails finding a single neighborhood that shares all the characteristics they heard about in their interview. "Students are very excited to try to pinpoint the exact neighborhood they visited," says Mr. Walk. "They are essentially using GIS skills to analyze the choropleth maps. They can't wait to find out if they're right."

After each interview, Mr. Walk projects the six choropleth maps and students enthusiastically explain which of Mexico City's 16 neighborhoods they just visited. "Students are able to read the maps and make inferences based the spatial distribution of Mexico City's neighborhoods," says Mr. Walk. "By visiting and mapping the neighborhoods, they begin learning about spatial inequality from the ground up." The students then repeat this process for three more neighborhoods: they meet a worker who has a humble brick house, a shop keeper who lives in an apartment, and a professor who lives in an upper, middle class home. "Pretending to go to the neighborhood and listen to the residents really appeals to many of my students who otherwise might not be engaged in this case study," says Mr. Walk. "Furthermore, my students from Mexico really shine during the activity. They become experts at interpreting what the other students are seeing and hearing."

Finally, students learn that spatial inequality does not exist only in large cities, but also in any area where differences in wealth affect how people live. Students discuss to what extent they can observe spatial inequality in their own communities. They use their newfound knowledge to interpret a world map that shows how nations rank based on the Human Development Index (HDI). "My students are surprised to learn that Mexico ranks quite high on HDI compared to most nations in the world," says Walk. "I am continually amazed at how they can apply what they learned from the Mexico City case study to the world at large. Watching them apply the big ideas, practices, and tools of geography to the world around them is really exciting."

Student Thinking and Experience

Recommendation 2: Design instructional materials that build upon students' prior geographic knowledge and experience and challenge students' thinking.

Students are naturally curious about how the world works—both in terms of physical processes and human experiences. Geography is a discipline that can excite this curiosity and also build upon and enrich the knowledge students have developed about their world. Instructional materials should capitalize upon this potential by demonstrating to students that geography is a dynamic and active discipline, and that it is relevant to their daily lives.

Educators have long recognized that children bring a wealth of knowledge and experience to the classroom. To content experts and other adults, this knowledge may seem incoherent or simply incorrect. Yet, research has shown that young learners operate with a well-developed set of theories and rules to help them explain how things work (e.g., Driver, Squires, Rushworth, & Wood-Robinson, 1994). When given the opportunity to share their ideas in the classroom, students can describe surprisingly rich accounts of what they believe is happening in a situation.

One issue that has plagued geography instructional materials, especially classroom textbooks, is the lack of attention paid to the knowledge students bring to the classroom. Many instructional materials have been designed to treat students as sponges who can absorb content when it is read or told to them. Unfortunately, when instructional materials are developed using this approach, the knowledge that students bring to the classroom is overlooked. This student knowledge has been developed over many years and is not something easily set aside.

Acknowledging and building on the ideas students bring to the classroom is an incredibly valuable component in the learning process. Instructional materials in geography need to offer classroom activities that elicit students' ideas and provide information and tools for teachers to anticipate and respond to these ideas. Our Committee recommends the following guidelines for design and implementation of instructional materials that value student geographic knowledge and experience:

- **Identify Prior Knowledge and Experience.** Instructional materials should include activities that connect to and draw from the rich diversity of students' prior knowledge and experiences relevant to geography.
- **Capitalize on Students' Interests.** Instructional materials should include learning opportunities that take advantage of students' natural curiosities and interests (e.g., asking questions that "hook" students).
- **Challenge Student Thinking.** Instructional materials should include thoughtful questions, discussions, and other activities to challenge student thinking.

Identify Prior Knowledge and Experience

Eliciting students' prior knowledge communicates value for what students already know; this approach also provides teachers with a glimpse at potential barriers to learning as well as resources they can build on as the learning process unfolds. Some teachers may believe that when students' prior knowledge is inaccurate, sharing it aloud with other classmates may hinder the learning of accurate content; however, educators can feel confident that students need to be aware of their own ideas and how they relate to geographers' ideas to aid the students' understanding of (versus memorization of) big ideas in geography. In addition, revealing student ideas is essential for teachers, enabling them to interpret how students' pre-existing ideas relate to the concepts to be learned and to respond with the most effective instructional moves (Ball & Cohen, 1996). Effective instructional materials can assist teachers in this process and provide suggestions for how to address a variety of student ideas that typically arise.

This Committee argues for the inclusion of more instructional activities to elicit what students already know about geography, including both oral and written activities (e.g., talking in groups, journaling, etc.). In addition, teachers need support in interpreting and responding to what students say in these elicitation activities. For example, instructional materials could provide discussion questions accompanied by examples of possible student responses (both right and wrong responses). The instruc-

Discussion of Student Ideas

Discussion is an indispensable classroom activity to include in instructional materials. Too often discussion gets shortchanged when instructional time runs out. Students might complete an engaging classroom activity but never discuss how their knowledge changed from the activity (Blumenfeld, 1992; MacIver, Young, & Washburn, 2002). There are two important aspects of discussion that developers and educators need to consider: (1) the nature of discussion, and (2) the prominence of discussion in the materials. Not all "discussion" can be considered true discussion, and research has shown that most classroom discussion is actually a form of recitation (e.g., Mehan, 1979). Recitation occurs when questions are posed that seek a single, predetermined response. Authentic classroom discussion, on the other hand, is more conversational and open-ended, where multiple ideas are critiqued and considered, even those ideas that may not be correct. Authentic discussions can yield a wealth of information about students' existing understanding and their progress in learning and should be included at strategic moments in the learning process. This latter point addresses the second consideration developers and educators should have—that discussion should be strategic and prominent in the material so that it is not eliminated when instructional time runs short. Discussion should be strategic in the sense that students have the opportunity to share their ideas at critical points in the lesson. Discussion also should be so tightly connected to other activities in the materials that it cannot be ignored.

tional materials could then suggest follow-up questions, activities, activity modifications, or other actions (such as setting an idea aside for now) to address particular student ideas.

Capitalize on Students' Interests

Engaging students' interest in geography is necessary for building an appreciation of and commitment to the importance of geographic learning among youth. Geography is a discipline that naturally lends itself to connecting to students' existing interests, building from those interests, and creating new ones. From investigating the students' local community to examining global phenomena, the opportunities to engage students in geography are abundant. This is especially true given students' inclinations toward technology, and the technological advances in geographic tools that can be utilized in the classroom (see Recommendation 3 for more information about using geographic tools).

Unfortunately, some geography classrooms may not capitalize on opportunities to connect to and spark interest within students. Even when they do capitalize on such opportunities, student interest may be short-lived. Instructional materials should attend to two important aspects of student interest—students' personal interests (i.e., the interests they have entering the classroom) and situational interests (i.e., interest that arises in a particular situation). Making connections to students' personal interests when designing instructional materials ensures a high probability that students will be drawn into learning the content. Yet, connections to personal interests are not always practical. Because instructional materials cannot connect well to *all* students' personal interests, situational interest becomes an important tool for engaging learners. Creating situational interest in geography involves grounding content in engaging geographic questions and problems students would likely find interesting, and then sustaining interest through classroom investigations that give ownership to students as they learn. Mitchell (1993) describes this as the *catch*—the initial stimulus that grabs student attention—and the *hold*—maintaining students' interest by empowering them in the learning process. Instructional materials need to attend to both, but especially to designing materials that will sustain interest through 'hold' activities that move beyond flashy bells and whistles that may lose student attention over time.

Challenge Student Thinking

Given students' natural curiosities about their world, it is not surprising that they bring a great capacity for learning to the classroom. With this capacity, we also find that students have developed ideas about the world, many of which are misconceptions or inaccuracies. Consider the following scenario: A middle school teacher divides students into groups to discuss what they already know about rivers. Looking at a basic drawing of a river flowing from the mountains to the ocean, three students discuss their ideas about the direction that rivers flow.

Mandy: *"Rivers always flow from mountains to the ocean, like in the picture."*

Thomas: *"The Mississippi River doesn't start in the mountains."*

Mandy: *"But most rivers do."*

Carmen: *"I think rivers flow south. The Mississippi goes from north to south."*

The three students clearly have ideas about how rivers flow at the outset of the activity. A geographer might explain that river flow depends on the topography and gradient, with the source beginning at a higher elevation than the mouth. Yet, novice learners may not identify topography as a factor in river flow. Instead it is commonly believed that rivers flow from north to south, even though many of the great rivers around the world (e.g., Nile, Rhine, Vistula, Ob, San Joaquin, and others) flow from south to north. It also is common for students to believe that rivers always start in the mountains, which makes sense given the representations of rivers students generally see in their early years of school. These representations depict rivers flowing from the mountains to the ocean through natural landscapes. Students rarely encounter representations of rivers flowing across relatively flat topography, or through urban areas.

Supporting students in developing more accurate understanding (and modifying or adjusting their misconceptions) can be a hard-fought process. Although we would like to simply tell students the "right" answer, research shows that students often are reluctant to change or set aside their existing ideas just because the teacher or the textbook says they are wrong (e.g., Osborne, Bell, & Gilbert, 1983). Instructional materials can assist teachers in this process, providing thoughtfully developed experiences that help students confront their own misconceptions. Instructional materials developers need to assume that students cannot simply be *told* the correct information; rather, students need experiences that call their existing ideas into question and experiences that present the geographically accurate ideas as more plausible options in comparison.

Conclusions

The knowledge, interests, and ways of thinking students bring to the learning environment should not be ignored when designing and using instructional materials. If instructional materials are to be effective in achieving their goals for supporting geographic literacy, designers must pay careful attention to student thinking in order to design materials that support teachers in working with students' ideas. As Ball and Cohen (1996) argued more than a decade ago, the most important influences on how teachers enact instructional materials depend upon, "what they think about their students, about what students bring to instruction, students' probable ideas about the content at hand, and about the trajectories of their learning that content" (p. 7). These same concerns, unfortunately, have not been at the forefront of many developers' minds when designing materials; this creates a disconnect between what developers provide to teachers and what teachers need to support their students' learning. Redesigning instructional materials in geography to attend to student thinking will not only provide better support for teachers, it will also bring much needed coherence to geography instruction by more closely aligning developers' intentions with teachers' needs.

Misconceptions and Instructional Materials

Misconception refers to wholly or partially incorrect ideas about disciplinary concepts. Unfortunately, the term "misconception" can communicate a negative connotation by suggesting students' thinking is meaningless, when in fact many of their ideas (while naïve) are natural precursors to learning more sophisticated content. "Alternative conception" is another term widely used to describe student ideas that differ from accurate disciplinary content. This term does not have the negative connotation of misconception. Other terms, such as "naïve ideas," "pre-existing ideas," and "preconception" have been used in similar ways. Misconceptions are important to the design of instructional materials because they can become barriers to learning accurate disciplinary content. When developers do not consider misconceptions in the design process, the work put into the design of materials may not fully support learning.

Recommended Reading

Michaels, S., Shouse, A. W., & Schweingruber, H. A. (2008). Chapter 3: Foundational knowledge and conceptual change. In *Ready, set, science! Putting research to work in K–8 science classrooms* (pp. 37–58). Board on Science Education, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Dove, J. (1999). *Theory into practice: Immaculate misconceptions.* Sheffield, U.K.: Geographical Association.

Common Core Connection

Many students find it challenging to change or let go of their misconceptions and preconceived notions, in geography as well as in other subject areas. Although it may be easier simply to provide students with correct information about a basic geographic fact or concept (e.g., the directional flow of the Nile River), research has shown that exposing them to carefully constructed instructional materials and/or "real world" experiences are much more likely to encourage students to give up their long-held misconceptions. The *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* (2010) provides a means for tackling this challenge while also exposing students to investigative and inquiry-based skills. These standards encourage teachers to provide students with opportunities to gather and analyze evidence that supports or refutes what they learn in class discussions, textbooks, and other sources of information. Below are examples of Common Core standards that, when integrated with the study of a geography concept or practice, can help students question their ideas and emerging understandings of a topic, and also support students in developing evidence-based understandings in geography (p. 62):

Grade 4 students:

- interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears;
- explain how an author uses reasons and evidence to support particular points in a text; and
- integrate information from two texts on the same topic to write or speak about the subject knowledgeably.

Grades 6 to 8 students:

- cite specific textual evidence to support analysis of science and technical texts; and
- distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

Grades 9 to 10 students:

- cite specific technical evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions; and
- assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific [and geographic] or technical problem.

Grades 11 to 12 students:

- cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account; and
- evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Formative Assessment to Tap into Student Thinking

Formative assessment is essential for tapping into student thinking during instruction. Educators are most familiar with summative assessments, which are used to benchmark student learning, to compare achievement among students, and to determine if students are performing at the desired level. Large-scale summative assessments enable performance comparisons across broad groups of students, such as different classes, school districts, states, and countries. However, the timeline on which these assessments are administered and scored limits opportunities for instructional improvement. They often are administered at the end of a school year, with results not available until students have moved on to new grade levels and teachers.

Unlike summative assessments, formative assessments can be used to measure student progress *during* the learning process and can identify gaps between where students are and where they need to be. By definition, formative assessment encompasses "all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (Black & Wiliam, 1998, p. 7). Formative assessment captures what students know and do not know at a critical point in an instructional unit, thus providing much needed information to the teacher for instructional decision making.

Recommended Reading

Edelson, D. C., Shavelson, R. J., & Wertheim, J. (Eds.). (2013). *A road map for 21st century geography education: Assessment* (A report from the Assessment Committee of the Road Map for 21st Century Geography Education Project). Washington, DC: National Geographic Society. Retrieved from www.natgeoed.org/roadmap

Photo courtesy of National Cathedral School

Photo courtesy of Teachers' Curriculum Institute

Making the Argument for Culturally Relevant Pedagogy in Geography

Engaging the experiences and knowledge of diverse learners requires an approach to teaching unlike traditional modes used in the past. Considering the widening achievement gap in public education, it is imperative to address the need for culturally relevant pedagogy in terms of practice, teacher preparation, and the development of instructional materials. Geography lies at the convergence of human and natural communities and links these two realms across time and space. Culture, the fabric that wraps our individual and collective humanities, is also a fundamental component of how geography is learned and shared.

Culturally relevant pedagogy is best described as that which uses the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for more effective teaching (Gay, 2010; Ladson-Billings, 1995, 2005). The implementation and growth of culturally relevant teaching practice is largely dependent on the capabilities of the educator in facilitating productive learning experiences. Educators who use culturally relevant practices:

- have heightened sociocultural awareness,
- hold affirming views of students from diverse backgrounds,
- see themselves as agents of educational change who will make schools more responsive to all students,
- hold constructivist views of teaching and learning,
- are knowledgeable about the lives of their students, and
- leverage their understanding of their students into learning opportunities (Villegas & Lucas, 2002).

These characteristics are not a revelation; however, the idea that they can be taught, developed, and supported during teacher preparation and in the design of materials is a dramatic shift from what we currently see in instructional materials and professional development (Lee, 1999).

The materials that best support culturally responsive practice create room and respect for students' background and culture, and they recognize how students see, perceive, and navigate their lived experiences. Such materials provide models and images that allow students to both see and question the beliefs and understandings they already have while expanding them to incorporate new knowledge. Taking culturally relevant pedagogy seriously means asking whether instructional materials capitalize on the attitudes, values, and beliefs that students bring to the classroom—or whether they marginalize students for being different (Gay, 2002).

In our desire to re-chart the goals, purposes, and methods of instructional materials in geography, cultural relevance serves as both a tool for teaching geography and as an outcome of the discipline. We hope to initiate dialogue that will enhance instructional materials by attending to students' lived experiences, especially the diversity found in U.S. classrooms today. Ultimately, our motive is to ensure equity and access for all students and to create learning experiences that value *who* students are and what they bring to learning geography.

Research on Student Thinking and Instructional Materials

For many years research on young learners described children's knowledge and ideas using a deficit model. While this approach yielded ample evidence that students struggle to understand accurate disciplinary content, those findings were hardly surprising. Learning is a process, and learners at different stages in this process will continue to hold wholly or partially incorrect ideas. Mastering a discipline is no easy task and likely not one achieved without exceptional instruction. The deficit model allows only researchers and educators to speak to the limitations of student knowledge as opposed to what students bring to the learning experience (Gelman & Baillargeon, 1983). Gahl Cole (2009) points out that children show significant agency in shaping their own spaces, and geographers should use children's experiences of places *outside* school to help them learn geography *inside* school. This resonates with earlier calls for educators to pay more attention to the wealth of experience students bring to the classroom from their out-of-school lives (Resnick, 1987). Failing to appreciate children's potential may cause teachers to limit opportunities for children's geographic learning (Butt, 2011).

From an early age students come to develop many intuitively sensible but inaccurate ideas about how both the physical and human-social worlds work. The literature on student ideas in science shows that children develop personal ideas about many elements of the natural world that are not consistent with scientific explanations (e.g., Driver et al., 1994). Sometimes these misconceptions about science and physical geography concepts are perpetuated by the graphics and illustrations used in instructional materials, such as the illustrations used in informational texts (e.g., Ford, 2006). Dove (1999) conducted an inventory of student ideas about physical geography concepts and found that students sometimes conjured up images about natural environments—like deserts—based on stereotypical examples shown in textbooks. For example, students believed that all deserts were like the 'sandy' Sahara desert, when in fact most deserts are rocky terrain with diverse vegetation. Instructional materials developers should pay close attention to the graphics, illustrations, and photographs used when teaching concepts to avoid reinforcing or causing student misconceptions (Cook, 2006). For example, research (e.g., Palmer, 1994; Wiegand, 1993) shows that students' geographic knowledge of Africa is based on many misconceptions and stereotypes about "jungles, wild animals, witch doctors, and people starving, living in huts, and living primitive lives generally" (Brophy & Alleman, 2006, p. 11).

Unfortunately there is little research on student ideas about geography content; this hampers instructional materials developers' ability to attend carefully to student thinking. With respect to physical geography concepts, research exists in the sciences (especially earth and biological sciences) that may be consulted (e.g., Driver et al., 1994; Leach, Driver, Scott, & Wood-Robinson, 1995, 1996a, 1996b; Phillips, 1991). For older learners—high school and beyond—two studies offer insights into misconceptions that persist as students learn more sophisticated geoscience and physical geography content (Nelson, Aron, & Francek, 1992; Libarkin & Anderson, 2005). There is some work on young learners' ideas about human conditions, such as food and shelter, provided by Brophy and Alleman (2006), but this work is limited to children in kindergarten through grade 3.

Despite the gaps in prior research on student thinking in geography, some current work focuses on the geography-specific competencies that students bring to the classroom. For example, when learning about location, it had been traditionally believed that students have only an "egocentric" frame of reference until they get older, but research shows that children as young as three can explain location from other frames of reference (Gersmehl & Gersmehl, 2007). Likewise, students make great strides in interpreting maps and globes during the elementary years, indicating that even young children have a great capacity for learning spatial thinking skills (e.g., Liben, Kastens, & Stevenson, 2002). It is evident that more research on student thinking in geography needs to be conducted, especially looking beyond basic foundational concepts such as location. Schmidt's (2011) work on student ideas on boundaries—highlighted on the following pages—is an example of instructional design heading in this direction.

Looking ahead, instructional materials developers and educators should be aware of a surging research

field in education focused on learning progressions. Learning progressions, most notably explored in science education, seek to describe developmental trajectories of student thinking over time, and how this thinking evolves with the use of certain instructional strategies and activities, as measured by carefully designed performance tasks and other assessments (Corcoran, Mosher, & Rogat, 2009; NRC, 2007c). Learning progressions naturally link theories of student thinking to the types of instructional materials and assessments that will be used in the learning process, so that teachers can tap into student ideas through assessments *and* also respond to student struggles with particular curricular activities. Instructional materials developers will likely find this approach useful, as it connects a research-based theory of learning with the design of classroom resources. Research in this area is primarily targeting science principles and practices, with some work on large-scale Earth systems (e.g., Massachusetts Department of Elementary and Secondary Education, 2010; Mohan, Chen, & Anderson, 2009; Plummer & Krajcik, 2010). For example, there is now substantial learning progression research on water cycling and human-engineered water systems (Covitt, Gunckel, & Anderson, 2009).

Recommended Research Reading

Brophy, J. E., & Alleman, J. (2006). *Children's thinking about cultural universals.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Corcoran, T., Mosher, F. A., & Rogat, A. (2009). *Learning progressions in science: An evidence-based approach to reform* (CPRE Research Report #RR-63). Philadelphia, PA: Consortium for Policy Research in Education.

Driver, R., Squires, A., Rushworth, P., & Wood-Robison, V. (1994). *Making sense of secondary science: Research into children's ideas*. London: Routledge.

National Research Council. (2007a). Foundations for science learning in young children. Chapter 3 in Committee on Science Learning, Kindergarten Through Eighth Grade, *Taking science to school: Learning and teaching science in grades K–8* (pp. 53–92). R. A. Duschl, H. A. Schweingruber, and A. W. Shouse (Eds.). Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Geography in Practice

Exploring Sense of Place

This case study focuses on a cross-curricular unit developed and taught to fifth grade students by teachers Ms. Lewis (social science) and Ms. Maffry (art) at National Cathedral School in Washington, DC. Elementary classrooms provide a unique opportunity to incorporate other disciplines into the study of geography. The content and practices in this unit focus on three disciplines—geography, visual arts, and language arts. Students explored the powerful geographic concept of "place" and the ways that humans use the arts (visual and prose) to express their connection to a particular place.

On the first day of the unit Ms. Lewis explained to students that geographers talk about the "perception of place" or "sense of place." Ms. Lewis wanted to know what her students thought about "place" and asked them to share what "sense of place" meant to them. Their initial ideas were reflected in responses such as "what a place is like" or "a place someone knows well."

Ms. Lewis' classroom exemplifies the second recommendation by:

- attending to students' prior knowledge and experiences, and
- challenging student ideas through discussion and other activities.

Ms. Lewis then asked if students could think of a place special to them. Hands shot into the air with a burst of excitement as students, too eager to wait to be called on, blurted out their favorite places. After allowing several students to share, Ms. Lewis passed out index cards. The students drew a line down the center and listed physical characteristics of their special place on one side and human characteristics on the other. On the back of the card they explained why that place was important to them. Students shared their work in groups of three, allowing each student to talk about their initial ideas of physical and human characteristics of place. "This activity opened up our inquiry into place, and gave students the opportunity to think about and share what they already knew on the topic" says Ms. Lewis.

In the next activity students were asked to compare two places that had special meaning to Ms. Lewis—the Arctic and Southwestern United States. Maps of both areas were projected onto a whiteboard and students worked in small groups to make lists of the types of landscape, weather, plants, and wildlife they would expect to find in these two regions. (For the purposes of this unit, human aspects of these areas were not explored.) When students finished, they shared their ideas with the whole group. During their sharing Ms. Lewis listened attentively but neither affirmed nor corrected their ideas—although sometimes other students did so. For example, one group listed polar bears and penguins as Arctic wildlife but a student in another group knew that penguins were found only in the southern hemisphere. "It was difficult for some students not to get validation that their answers were right," describes Ms. Lewis. Students' lists were posted around the room, and Ms. Lewis explained to students they would be free to add or delete to those in the coming days.

Students work with Ms. Maffry to develop artwork of a place that is special to them. Photo courtesy of National Cathedral School

Each of the two regions was studied separately over a series of days. Ms. Lewis began the study of each region by showing images of her travels to Svalbard in the Arctic and to locations in the Southwestern United States. Students were asked to take notes on landforms, as well as animal and plant life. Time was given for them to compare notes with each other and then to compare these with their initial list of characteristics. After looking at the photographs many students became more confident that the Southwest did not have a lot of rainfall. They expressed surprise that there were mountains in the Arctic and quickly added that to their lists.

In the next activity students further explored the physical characteristics of these two places through paintings by Ingrid Jangaard Ousland (Arctic) and Georgia O'Keeffe (Southwest). Ms. Lewis prompted her students to analyze these paintings in terms of how they communicated a sense of place. Students were asked to share how the paintings compared to the photographs they had seen in the previous activity. In addition to the visual component, students also read excerpts of pieces written by Knud Rasmussen (Arctic) and Willa Cather (Southwest). As they read they were to underline any clues they found about physical characteristics. In the discussion that followed students added to and crossed out items on the lists they had started on the first day. Ducks and geese in the Arctic were a surprise for many students, as were Southwest descriptions of ceaseless winds that bent and twisted trees to the east. "The discussion was rich and students quickly added new items to their list. When students wanted to scratch off items, I asked them to explain their reasoning. For example, one group wanted to remove 'plenty of rainfall' from their Southwest list. They explained that the images and Willa Cather's description of desert made it clear this was not an area with a lot of rainfall," says Ms. Lewis.

After the materials had been examined for the Arctic and Southwest, students were asked to discuss how these two places were alike and different. "This comparison was a critical moment in the unit because students initially believed these two places were completely different," says Ms. Lewis. Most students were confident that the Southwest was a desert, but that the Arctic had a lot of precipitation in the form of snow. But when Ms. Lewis projected annual precipitation charts for different places in the Southwest and Arctic and asked students to examine the data, exclamations of surprise erupted as students discovered that precipitation patterns in the Southwest and Arctic were similar—both were deserts. This activity challenged students' ideas about the two regions and taught students that while the places are quite different, they are both examples of dry landscapes.

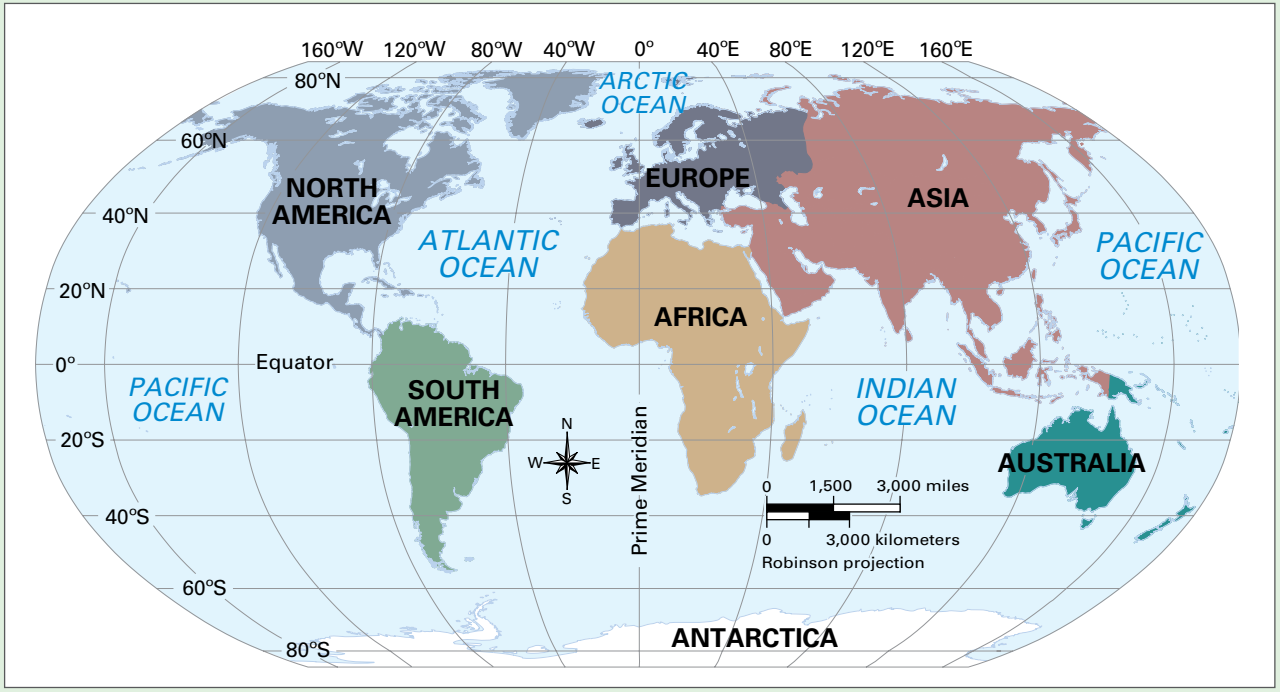
The final activity gave students the opportunity to reflect again on the place they had written about on the first day. In small groups students reviewed the passages written by Rasmussen and Cather and shared with each other words they thought created a strong visual image of a particular place. Ms. Lewis then asked students to use words to create images of their own special place. Their art teacher, Ms. Maffry, reviewed the artwork of Ousland and O'Keefe with students and developed a lesson on how to work with pastels so students could create simple drawings of their special places. An art gallery was created in the fifth grade hallway with students' mounted artwork and prose of their special place on display. "Many who viewed the work in the gallery were very moved by the power of the students' work," describes Ms. Lewis. Although none of the students had gone to the Arctic and only a few had visited the Southwest, all had a new connection to these places because of their new geographic understanding of "place."

Geography in Practice

Contesting Boundaries

This case study illustrates a curricular unit taught to ninth grade students on the geographic concept of boundaries. Ms. Wilson's unit focuses on how to challenge students' preconceived notions of boundaries, a concept students tend to feel confident about until they are prompted to take a closer, more critical look. Focusing on dividing continents using boundaries, students come to realize that drawing concrete boundaries between continents is not a straightforward task, and that characteristics of people and places are not easily divided using lines on a map.

Boundaries are an important concept in geography curricula. They have both abstract and concrete meanings. Concrete ideas of boundaries are easier to portray, for example, on political maps that use solid lines to represent boundaries between nation-states, states, provinces, or municipalities/districts. These lines distinguish one place from another and, in the process, include some areas and exclude others. But despite the visibility of lines on maps, the lived reality around those lines is far less stable. "There are few places in the world where those lines are literally etched into the landscape, mainly along rivers and other bodies of water" says Ms. Wilson. In reality most boundaries are less clear, and are permeated and contested by people every day. The lesson below describes instructional materials that challenge student thinking about a seemingly simple concept of boundaries.



Map of world continents map with regions identified. Image courtesy of Teachers' Curriculum Institute

At the beginning of any instructional unit, it is important to understand what students already know about the topic. This unit used an open-ended activity to elicit students' ideas about boundaries and continents. Students were divided into small groups and given a blank physical map of the world, without political boundaries, to divide into continents. They were directed not to draw general circles, but to make clear boundaries around and between the continents and to be prepared to defend how and why they divided the world this way. Some divisions are straightforward; for example, few groups struggled to label Australia or Antarctica. However, the activity required students to articulate their own questions about dividing conjoined landmasses into distinct continents, for example, where is the boundary between North and South America, Africa and Asia, and Asia and Europe?

To make the students' ideas visible, each group then shared and discussed the rationale behind their bound-

Ms. Wilson's unit exemplifies the second recommendation by:

- attending to students' prior knowledge and experiences, and
- challenging student ideas through discussion and other activities.

aries. Throughout the discussion, Ms. Wilson posed problematic scenarios to prompt students to reconsider their choices (e.g., European Union, North American Free Trade Agreement, World Cup Football Federation). With these scenarios students began to see inconsistencies in their boundaries. A primary issue was whether to divide continents using national borders or physical features (natural or human-made). For example, many groups were comfortable placing Russia on two continents (using the Ural Mountains as a dividing point) but uncomfortable allowing Egypt, Turkey, and Panama to split continents. Moreover, students were determined to extend the border around rather than follow the Ural River to divide Kazakhstan. Some students wanted to divide North and South America between Mexico and Guatemala/Belize. Throughout, issues of known national political boundaries remained strong. "When asked about islands, students usually revert to claims about continents being landmasses, but this does not help them respond to questions about why Antarctica and Australia are continents but Iceland and Greenland are not. Through this discussion, the students began to recognize that their criteria were inconsistent" says Ms. Wilson. The inability to provide boundaries for continental divides suggests that a continent is not easily defined. More importantly, this activity sets up a discussion of the human-ness and social meaning that influences the drawing of boundaries. Boundaries are no longer stable and objective, and students increasingly question what they previously assumed was true.

The other activities in this unit used materials that drew attention to what boundaries are and how they function. The second activity examined the people on the continents and asked students to make universal claims about the people living there. The third activity sought counterexamples to dominant physical and human identifiers of a continent. The materials used in each of these activities reflected different ways of representing people and daily life within these continents. "Through these activities, students quickly notice that their dominant ideas about a continent, the ones that helped them draw the lines, are not always accurate or helpful" says Ms. Wilson. For example, they struggle to see Israelis, Kazaks, Chinese, and Nepali all as Asian. In particular, many characteristics are inconsistent with their identification of "Asia" as "East Asia." In Africa, students found themselves quite comfortable placing Egyptians with their nearby Arab-Asian peers, groups that were divided by a continental boundary the day before. At the end of the unit, students were asked to revisit their initial ideas from the opening activity. They were given the opportunity to redraw "continental" boundaries using what they have learned. At this point, many students draw boundaries that are regional and not true to their original sense of a continent, and across the class these boundaries showed great variation from one student to the next.

Most students enter with a certain confidence about boundaries, their creation, and their meaning. They accept the need to organize the world through boundaries, though they have not been given much opportunity to consider the ways in which boundaries are penetrable, political, and exclusionary. "These activities tend to make students uncomfortable because

Africa's political and ethnic boundaries. Image courtesy of Teachers' Curriculum Institute

students must struggle with their preconceived ideas about people and places. Along the way, students realize there are more questions than answers, and in this case, the divides between continents are more contested than absolute," says Ms. Wilson. They do not arrive at a "right answer" but use the activity to form and defend "an answer." Geography is a way of organizing and studying the world and is influenced by perception and interpretation, and this unit focuses on students realizing that concepts they thought they knew with such certainty actually are a little more complicated and perplexing.

Engaging Classrooms

Recommendation 3: Develop instructional materials that use teaching strategies to engage all learners in meaningful explorations of geography.

All teachers have access to a teaching toolbox full of various strategies and methods to be used in the classroom. Depending on the content, the teacher can choose the best "tool" from his or her toolbox to use in a particular situation, often making the selection based on past experience, or relying on guidance from instructional materials. Skilled geography teachers, just like expert carpenters, have more diverse toolboxes than novice teachers, and therefore greater options in the strategies and methods they might employ. They also have a greater awareness of who their students are and how they respond under certain learning conditions. The vision of geography education laid out in this report calls for equipping all teachers—veterans and novices alike—with a diverse repertoire of methods and strategies proven effective to teach geography content.

As teachers make day-to-day instructional decisions, we want them to be able to choose from a variety of research-based methods to teach geography and to develop an overall approach to geography education that captures the dynamic nature of the discipline itself. The "what" of the discipline, as laid out in Recommendation 1, and "who" will be learning, as described in Recommendation 2, are only part of the equation for effective teaching and learning. Bringing these two together and crafting powerful learning experiences for students involves choosing the best means for instruction—the "how," which is discussed below.

Instructional materials are potentially the most useful resource for helping teachers craft productive learning experiences. Developers can thoughtfully design learning experiences based on what the content affords them, and on the likely experiences students bring to the classroom, to help teachers understand and utilize the best teaching methods and strategies available. At present, however, many of the instructional materials in geography utilize limited methods for conveying content—typically promoting direct instruction through lecture, reading, and recitation. Most students do not respond well to these learning conditions, and sadly, such modes of instruction do not take advantage of one of geography's greatest assets—that it is a dynamic discipline with a high degree of relevance to students' lives.

It is essential for instructional materials to provide teachers with resources that promote utilization of effective teaching methods and strategies. Curriculum developers should draw upon methods and strategies that encourage and support active engagement with content through geographic inquiry—asking questions, pursuing investigations, and learning how to use geography to explain the world. The guidelines below are provided for curriculum developers and educators to assist with the design and use of the most effective instructional approaches. While this list is not inclusive of every characteristic of good geography instruction, it captures general approaches to instruction that have been proven effective and useful in geography. High-quality instructional materials should incorporate these characteristics whenever possible:

- **Engagement with Contemporary Geographic Questions.** Programs should engage students in asking questions about contemporary geography issues and problems.
- **Exploration of One's Local Geography.** Programs should immerse students in the study of their local geography and connect geography to students' lived experiences.
- **Vivid Experiences Using the Tools of Geography.** Programs should use teaching methods that capitalize on geographic tools to create vivid firsthand and vicarious experiences.
- **Variety of Learning Experiences.** Programs should engage students using diverse modes of instruction and attend to the inevitable differences among students.
- **Application of Knowledge Across Contexts.** Programs should engage students in the application of geography content and practices to a broad range of contexts.
- **Developing the Language of Geography.** Programs should build disciplinary language in geography through thoughtful experiences with geographic content and practices.

Problem-Based Learning in Geography

Problem-based learning (PBL) is perhaps one of the most widely accepted strategies for teaching geographic ideas and practices at both the K–12 and post-secondary levels, although there is limited empirical support for its use in geography (Pawson et al., 2006). PBL is an instructional method in which students learn through facilitated problem-solving. PBL has a rich history in medicine, engineering, and other areas of science education. According to Erlauer (2003), "Of the dozens of ideas and strategies, one that would appear to be the most universally accepted as highly effective in enriching the brain is problem solving…Jensen (1998) asserts that challenging problem solving is the single best way to enrich the brain" (p. 97).

PBL in geography has the potential to develop critical thinking skills among students, to provide opportunities for students to develop and apply theories, to engage students in skills and techniques to solve real-world problems, and to promote learning-by-doing in the field (Liu, Bui, Chang, & Lossman, 2010; Nation, 2008). It has been noted that PBL is well-suited for geography education, but it is not systematically used in the curriculum (Pawson et al., 2006). Geography is a discipline that is inherently collaborative, interdisciplinary, and enhanced greatly by the use of geographic tools—all of which make it an ideal subject-matter to explore through PBL methods.

Engagement with Contemporary Geographic Questions

Engagement with geographic practices is under-utilized in geography materials today, as discussed in Recommendation 1. Geographic inquiry includes the important geographic practice of asking interesting and researchable questions. With assistance from teachers and instructional materials, students can ask questions that set them up for rich inquiries into geographic topics. While questions can be constructed around hypothetical problems, one of the beauties of geography is that such hypothetical questions are mostly unnecessary—geographic questions can be asked and pursued using real-world issues and real-world data, making the exploration of these questions authentic and relevant for students.

Several teaching methods employ this practice-based approach to instruction, most notably problem-based learning. In problem-based learning, instructional units are developed around engaging questions or problems that students investigate. These materials can use a case-based or project-based approach, both of which immerse students deeply in specific content as they work to find answers to their questions. Developers and teachers should be aware that the questions used in problem-based learning are not straightforward and easy to answer. Usually they are "complex, ill-structured, and open-ended…they must also be realistic and resonate with students' experience" (Hmelo-Silver, 2004, p. 244). Instructional materials that utilize such approaches also need to provide support for teachers who may be hesitant to start down a path of instruction that is not clear-cut and predictable. Students, however, can benefit from engagement with such challenging questions because they support the development of important problem-solving and critical thinking skills as well as the ability to flexibly use and apply knowledge across contexts (Erlaur, 2003; Hmelo-Silver, 2004).

Exploration of One's Local Geography

Connecting to students' lived experiences in their community is an approach to geography instruction with high probability of being interesting to students. Even given engaging topics in geography and innovative materials, when such topics are not connected to students' lives and local community, interest in learning geography may be limited (Klein, 2005). Local geography can be used to draw students into learning experiences, especially when they are given the opportunity to share

Ms. Conrad's Hopkins Elementary students do fieldwork in Portland, Oregon. Photo courtesy of Marika Conrad, Oregon Geographic Alliance

their own knowledge as a starting point for discussion. Developing students' understanding of local geography can be further supported by visiting local places to collect information or by observing and analyzing local geographic data.

Scaled-up instructional materials, such as textbooks, may find this approach to be challenging. It is unrealistic for a textbook developer to design programs that speak to students' different localities. However, large-scale developers can provide suggestions for teachers about aspects of local communities that could be investigated given the content under study (e.g., a template for studying neighborhood change or a suggestion to investigate the local water supply). They also could point teachers to resources that may offer geographic data specific to their locations (e.g., U.S. Geological Survey, National Oceanic and Atmospheric Administration, Environmental Protection Agency, etc.).

With respect to small-scale and local curriculum programs, even more can be done to infuse local geography into the curriculum. One teaching method that uses this approach is place-based education. Place-based education has been characterized by some as an exploration of the natural world (Sobel, 2004; Woodhouse & Knapp, 2000), but others have argued for its importance for students living in urban environments (Gruenewald, 2003). This Committee defines place-based education as an instructional approach that situates learning in and about the local community and environment, and an approach that intentionally leverages aspects of the local community to teach concepts and to build upon students' sense of place (adapted from Semken & Freeman, 2007; Sobel, 2004). The concept of "place" is a cornerstone to geographic thinking, and can be found within the Joint Committee on Geographic Education (1984) and *Geography for Life* (Heffron & Downs, 2012), as well as throughout state standards. Instructional materials can utilize a place-based approach to teach a variety of geographic ideas through explorations of folk culture and cultural traditions, social problems, environmental problems, human infrastructure, and engineered systems, with a focus on how all of the above are interconnected. Ideally, instructional materials using this approach would build investigative experiences into the materials so that students are asking questions about their local communities, collecting and/or analyzing local geographic data, and developing a richer understanding of their local geography.

Many place-based educators advocate for getting students out of the four walls of the classroom to study their local community and environment first-hand. One way to do this in geography is through fieldwork. Collecting and analyzing local geographic data can be especially powerful for students. Fieldwork has long been a requisite for geography studies in higher education, but it has been less emphasized in K–12 and teacher education (Bednarz, 1999). However, fieldwork is recognized as an important component to learning geography, for both teachers and students (Foskett, 2004; Kent, Gilbertson, & Hunt, 1997). It is an excellent way to make geographic concepts relevant for K–12 learners and to connect concepts to students' prior experiences; fieldwork also can offer a vast laboratory of experiences for students to engage in geographic practices (Elwood, 2004).

Integrating fieldwork into instructional materials can be challenging. Competing pressures within schools, such as time, funding, and concerns for safety, may limit teachers' abilities to use field experiences in geography classrooms. However, fieldwork can be conducted locally within the schools' campus. For example, middle and high school students can map traffic patterns and congestion during passing periods, and elementary students can do "observational walks" to identify vegetation on the school grounds (for more examples, see Rice & Bulman, 2001). Developers also can include alternative experiences with local geographic data if students are unable to collect the data themselves. For example, they can provide supplemental data sets and possibly video of the data collection process. While these vicarious experiences with data sets and video cannot replace authentic field experiences, they can provide students the opportunity to understand how to collect and organize local geographic data.

Teaching Local Geography

Often geography in the K–12 curriculum, particularly in middle and high schools, is presented at a global scale. However, some of the most powerful learning experiences can begin with local topics. This approach to geographic education emphasizes hands-on, real-world learning experiences with geographic concepts and practices that can enhance students' involvement in their communities and their appreciation for the natural world in their immediate setting. Below are examples of inquiries that could be pursued around local phenomena:

- charting local park usage by gender, age group, ethnic background, and other data to determine who uses the park, and if there are incentives or barriers to one group over another;
- remapping the parking lot of their school to maximize space usage, safety, and efficient flow of vehicles;
- studying land usage along a stream that flows through the community, to determine what factors might influence water quality and quantity;
- mapping local grocery stores and comparing distances to neighborhoods; then charting income levels and drawing conclusions about socioeconomic level and access to stores; and
- taking local school district maps of elementary school zones and comparing income levels of households in each zone using census data; and then reporting findings to the school board.

Vivid Experiences Using the Tools of Geography

Geography education is poised to be a leader in developing and implementing innovative educational technologies, especially given the surge in geospatial technologies that are becoming increasingly popular tools, both in and out of schools. Learning geography should be active and hands-on when possible, providing students with the opportunity to engage with the tools of geography. Geographic information systems (GIS) and online mapping and data websites are key tools of geography along with the more traditional maps, models, and other geographic representations. All of these learning tools should be incorporated where appropriate to augment the learning experience. Importantly, instructional materials should avoid simply *showing* these tools to students and instead should include opportunities for students to use and manipulate the tools themselves toward a meaningful goal.

The use of geospatial technologies in K–12 instructional materials has many benefits in learning. One viable attribute of using geospatial technologies is that these technologies afford students a chance to view the Earth differently and dynamically. Most textbooks and other hardcopy materials have obvious limitations in modeling for students how to think spatially, but web-based GIS activities can promote precisely this skill (Patterson, 2007). Online programs provide ample, animated, and accessible geospatial data that are free and available. These data can be utilized in many instructional resources to study a variety of geographic phenomena. With such readily available data and tools, students and teachers have more opportunities to explore the relationships that occur across Earth's landscape, making web-based geographic inquiries a possibility for *many* geography classrooms instead of only a few.

Variety of Learning Experiences

Teachers must continually make choices when planning instruction in order to reach all students. Of all these choices, teachers must select strategies and methods that are not only proven to be effective, but ones that will engage students with different learning strengths and challenges. Classrooms in the United States are diverse; they often include students of varied racial and ethnic groups, cultural and home experiences, gender and sexual orientations, English language fluency, and socioeconomic status. In addition, students vary in their understanding and experiences within the discipline. Well-designed instructional materials can help teachers reach this diverse audience by incorporating a variety of instructional strategies, along with knowledge about when and how best to use them.

In Recommendation 2, we discussed how instructional materials can help teachers engage students from a range of diverse cultural backgrounds (see the section on

Geospatial Technologies and Spatial Thinking

Instructional materials utilizing geospatial technologies, such as GIS, can promote key skills in geographic learning (e.g., Kulo & Bodzin, 2011; Liu, Bui, Chang, & Lossman, 2010; Nielsen, Oberle, & Sugumaran, 2011). In particular, they can promote spatial thinking skills that are "used in everyday life, the workplace, and in science to solve problems using concepts of space, visualization and reasoning" (Kidman & Palmer, 2006, p. 290). Perkins, Hazelton, Erickson and Allan (2010) conducted a study to enhance spatial awareness of middle school students by using curriculum materials supported by GIS to learn about ecological succession. Their work integrated a place-based approach to instruction, with emphasis on utilizing geographic tools. "Using a place-based approach is inherently more interesting to students than using a generic, one-size-fits-all data set, and the results demonstrate that using GIS as a classroom tool can effectively develop students' spatial awareness while they learn more traditional topics" (Perkins et al., 2010, p. 218). For a review of research on learning and spatial thinking, please refer to National Research Council (2007b).

Using a new technology to teach content is not an easy task and, though attractive, often can be daunting and intimidating for even the most prepared teachers. The need for increased teacher exposure to geospatial technologies in instructional materials and during preservice and inservice training is great. Teachers who are inexperienced with such technologies may lack the confidence needed to teach content effectively (Baker, Palmer, & Kerski, 2009; Kerski, 2003; Shriner, Clark, Nail, Schlee, & Libler, 2010). Wiegand (2006), among many other researchers, argues that training among teachers is critical. Without support from instructional materials and professional learning opportunities, teachers may find themselves confused or uncertain about using technologies; as a result, the potential benefits of using geospatial technologies may be undercut. Developers interested in incorporating such technologies in their instructional resources need to carefully consider how best to support and train teachers in using the technology, in order to build teacher confidence and provide them with a clear purpose for how and why technologies are being utilized.

Recommended Reading

Kerski, J. J. (2003). The implementation and effectiveness of geographic information systems technology and methods in secondary education. *Journal of Geography, 102*(3), 128–137.

Milson, A. J. & Alibrandi, M. (Eds.). (2008). *Digital geography: Geospatial technologies in the social studies classroom.* Charlotte, NC: Information Age Publishing, Inc.

"Culturally Responsive Pedagogy"). We also recognize that students within a given classroom will begin an instructional unit with different levels of understanding and bring different means of engagement to the learning process. It is now commonplace to hear terms such as "learning styles," "multiple intelligences," and "differentiated instruction" in relation to designing materials. Although there is some skepticism regarding this field of study (see Brophy, 2004, for a discussion), few would disagree that students bring different learning approaches to the classroom. Instructional materials need to take this into account, and incorporate more than one way of engaging the students with the content (Erlaur, 2003). This is not, however, "a mandate to teach every topic in seven or eight different ways" (Brophy, 2004, p. 344). Catering only to students' strengths could limit students in making progress on their weaknesses in learning (e.g., McCarthy, 1990).

Differentiated instruction tailors instruction to students' needs by allowing multiple options for taking in information, making sense of ideas, and expressing what was learned (Tomlinson, 2001). The ultimate goal of differentiated instruction is to *know* who the students are—their level of understanding, learning strengths and weaknesses, background and prior experiences, etc.—and then design instruction so that *all* students have ways to access and engage with the content. As described in Recommendation 2, understanding "who" the students are and what they bring to the learning experience is key for differentiating geography instruction.

Application of Knowledge Across Contexts

Instructional materials that provide opportunities for students to make connections across space and time, and at various scales from local to global, can lead to meaningful and useful learning of geography. One of the most promising strategies for improving students' geographic knowledge is to make connections through application activities (i.e., those in which students are *using* knowledge to explain a new situation or context). Application of geography, and the process of *transferring* knowledge to new contexts, helps learners to make geographic information more readily accessible and flexible in their working memory (e.g., Bransford, Brown, & Cocking, 1999; Erickson, 2002). Rather than ending instruction once students have learned the new concept or practice, instructional materials should include activities in which students develop a deeper understanding of the ideas by using and *applying* the new knowledge in a variety of situations. This approach gives students a chance to clarify misunderstandings and to gain an appreciation of the wide usefulness of the targeted big ideas. Such applications also should support students in making connections across spatial scales, places, and time—all of which are important for building geographic understanding.

Developing the Language of Geography

As the National Research Council (2007c) explains with respect to learning science, "A steady stream of reading sections from textbooks, taking notes on definitions of key terms, and taking exams that test recall, for example, leaves students with a distinct, and problematic, sense of what it means to know and do science" (p. 271). This also is true for students in geography classrooms. Learning to think geographically involves being able to fluidly *communicate* geography utilizing appropriate concepts and terms, and backing up conclusions with geographic evidence. The ability to communicate effectively comes only with practice.

Learning to communicate in the language of geography is somewhat like learning a new language, which requires targeted and scaffolded language activities. The language activities that occur in a geography classroom should be intimately connected to the geographic inquiries taking place. In studies of science classrooms, researchers found that students learn better and are more engaged with texts when they read disciplinary texts alongside hands-on, in-the-field, or other types of investigations (e.g., Guthrie et al., 2004; Palinscar & Magnusson, 2001). Maps, charts, and graphs also are critical to the study of geography. Instructional materials should support students in reading and making maps, charts, and graphs to enhance their understanding of geographic concepts and to develop their ability to use these text types when they communicate. Likewise, students need opportunities to communicate their ideas in writing, beyond answering chapter review questions in the textbook. Teachers have found success using notebooks in science class, as a way for students to journal their ideas before, during, and after investigations (Baxter, Bass & Glaser, 2001). Notebooks can be a place where students construct their geographic explanations based on evidence they observed and analyzed in their investigations. Given the promise of using notebooks, it is important for developers to recognize that students will not spontaneously use notebooks effectively. They will need help from the teacher and from the instruc-

Students study images of Adelie penguins to determine the effects of global climate change on the ecosystem of Antarctica. Photo courtesy of Teachers' Curriculum Institute

Students learn about the geography of Latin America by analyzing thematic maps and simulating basic GIS skills. Photo courtesy of Teachers' Curriculum Institute

Common Core Connection

The Road Map Project guideline to "develop the language of geography" is closely aligned to the goals of the *Common Core Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* (2010; hereafter ELA & Literacy Standards). This document sets forth an integrated view of literacy in the content areas by developing reading, writing, and communication skills with subject-specific contexts.

Below we select one standard from each of the Common Core strands to show that such standards, when integrated with learning geography, can help students become better consumers and communicators of geographic information.

Common Core Standard	Example Standard
Reading	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
Writing	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
Speaking/ Listening	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
Language	Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

The ELA & Literacy Standards also focus on building literacy skills across grade levels. One elementary example of this is reading informational texts:

Reading Standards for Informational Texts, p. 14		
Grade 2	**Grade 3**	**Grade 4**
Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.	Use information gained from illustrations (e.g., maps, photographs) and the words in the text to demonstrate understanding of the text.	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

tional materials. Developers should make these types of language activities central features of investigations rather than afterthoughts. Otherwise, it is likely that teachers and students will not use them systematically and effectively.

Disciplinary terminology is another important component of language in geography. Traditionally, students come to learn "vocabulary" in geography through reading bolded words in the textbook or jotting down a vocabulary list from the teacher. Instructional materials should move beyond a bolded list of terms, to explicit discussions about new vocabulary and activities that have students practice using those terms in meaningful ways. Vocabulary development should occur on an as-needed basis (Jenkins, Stein, & Wysocki, 1984), in which a geographic term is introduced and discussed because it is essential for making sense of what students are learning. For example, if students reading about population trends in China see a population pyramid alongside the text, it becomes imperative to introduce the term "population pyramid" and explain how these are constructed. Students should then be supported in using the term "population pyramid" as they continue to develop geographic explanations about populations.

Conclusions

Regardless of choice of strategy or method to engage students in learning geography, instructional materials should help promote a positive disposition toward geography among students and allow them to "do geography" in their classrooms. The fastest way to kill student interest in geography is to teach the content as rote memorization from a textbook or set of maps. While students may perform well when asked to recall this information on tests, teaching methods that convey geography in this way are not only doing a disservice to the discipline, but also are potentially stunting future interest in and use of geography among students. The guidelines for effective instructional materials described above can build this positive disposition toward geography, improve students' progress toward geographic literacy, and employ methods that will capture a more authentic view of geographic work.

Recommended Reading

Bransford, J. D., Brown, A. L. & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

Good, T. L., & Brophy, J. E., (2002). *Looking in classrooms* (10th ed.). Boston: Allyn & Bacon.

Research on Subject-Matter Teaching

A teacher's approach to instruction, which can be heavily dependent on the instructional materials at hand, has profound influences on student learning (see Brophy, 1986, for an overview, and Brophy & Good, 1986). Students show greater or lesser achievement in the classroom as a result of decisions made by the teacher and the instructional materials. As Brophy (1992) explains, "Clear explanations and modeling from the teacher are important, but so are opportunities to answer questions about the content, discuss or debate its meanings and implications, or apply it in authentic problem-solving or decision-making contexts. These activities allow students to process the content actively and 'make it their own'" (p. 5). Helping students make the content their own involves instructional activities that delve deep into powerful disciplinary ideas and practices. Superficial memorization is insufficient for such learning.

Teaching within a particular subject matter, however, means that teachers must tailor their instructional practices to best convey the essence of the discipline. As Shulman (1986) asks, "How do teachers decide what to teach, how to represent it, how to question students about it and how to deal with problems of misunderstanding?" (p. 6). Subject-matter teaching involves crafting learning experiences with a high degree of awareness of the content, of what students bring to the learning process, and of how best to approach teaching particular disciplinary ideas and practices. Shulman dubbed this type of instructional knowledge

pedagogical content knowledge. Shulman's argument about pedagogical content knowledge echoes what John Dewey called "psychologizing the curriculum" (Dewey, 1964; Smith & Girod, 2003), which gets at the same issue—that disciplinary knowledge cannot simply be transmitted to students via lecture; rather, productive learning experiences happen when teachers know the best methods for teaching particular content to students. Teaching students about the meaning of boundaries, for example, might require a different set of teaching strategies and activities than teaching students how to study a local transportation problem.

The idea of pedagogical content knowledge stemmed from the observation that teacher preparation programs taught subject matter knowledge and pedagogical knowledge in separate courses and programs. These programs for teachers did not link subject matter knowledge to the actual teaching of the subject in the classroom (Abd-el-Khalick & BouJaoude, 1997). Several studies demonstrated that beginning teachers, in particular, struggle with transforming their own understanding of content into an appropriate teaching method (Abd-el-Khalick & BouJaoude, 1997; Gregg, 2001).

Instructional materials can be a valuable resource in helping teachers determine the most appropriate methods for teaching content. It is expected that teachers will be able to present subject matter to students in many ways, but less knowledgeable teachers typically focus on factual recall from textbooks while more knowledgeable ones insert supplementary materials and modify textbook activities when necessary (Carlsen, 1991).

Even when textbook developers intend for geography teachers to actively engage students in the content, teachers with limited pedagogical content knowledge will default to factual recall through lectures and recitation rather than use interactive instructional methods such as authentic discussions and inquiry. Developers need to consider how materials can support building teacher content knowledge and pedagogical content knowledge in addition to student learning if they want teachers to have confidence in using innovative, engaging, and effective instructional methods (see Recommendation 5 for additional discussion on content knowledge and PCK in professional development).

Another type of knowledge teachers need to possess is curricular knowledge, which is knowledge that "represents the full range of programs designed for the teaching of particular subjects and topics at a given grade level" (Shulman, 1986, p. 10). According to Shulman, a skilled teacher should have the knowledge of alternative methods of teaching, as well as lateral and vertical curricular knowledge. Lateral curricular knowledge is the ability to relate the subject material to other subjects being taught for that grade level, while vertical curricular knowledge is familiarity with objectives within a subject and across grade levels. Situating the learning of disciplinary content and practices into the larger picture of curriculum is essential to determining what is developmentally appropriate for students. *Geography for Life* is a critical resource in supporting vertical curricular knowledge, and developers can highlight this in materials by calling attention to how big ideas in the standards will be developed across the year and over multiple years. This can help teachers construct reasonable goals for student learning, given that mastery of geography concepts will not happen in a single lesson or even a single unit and might take several years of study. Instructional materials also can support teachers in designing teaching agendas and lesson scripts (Leinhardt, Putnam, Stein, & Baxter, 1991), which involves setting goals for learning in a particular lesson or unit. The materials also can suggest actions the teacher can take to ensure that the learning is successful.

Recommended Research Reading

Brophy, J. E. (1992). Probing the subtleties of subject-matter teaching. *Educational Leadership, 49*(7), 4–8.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher,* 15(2), 4–14.

Smith III, J. P. & Girod, M. (2003). John Dewey and psychologizing the subject-matter: Big ideas, ambitious teaching, and teacher education. *Teaching and Teacher Education, 19*(3), 295–307.

Geography in Practice

FieldScope Water Quality Project

Geospatial technologies, such as geographic information systems (GIS) and global position systems (GPS), are innovative tools used by contemporary geographers to collect, organize, and analyze geographic data. There are many educational programs that use these types of technologies to promote student engagement in geography. One such program, FieldScope, is a scale-up version of what many formal and informal science programs have done to collect and share geographic and scientific data. Funded by the National Science Foundation, and supported by National Geographic Society, FieldScope has allowed hundreds of students, teachers, and interested citizens to participate in large-scale geographic and scientific research.

Geospatial tools, such as FieldScope, exemplify the third recommendation by:

- giving students vivid experiences with contemporary geographic questions and tools used to pursue productive inquiries, and
- promoting exploration of students' local geographies through collecting and sharing geographic and scientific data.

FieldScope (www.fieldscope.org) is a web-based mapping, analysis, and collaboration tool designed to support geographic investigations and to engage students as citizen scientists investigating real-world issues, both in the classroom and in outdoor education settings. The program enables students to upload their own field data, including quantitative measurements, field notes, and media, such as photos. Students can integrate their fieldwork and data with that of their peers and professional scientists and geographers, adding meaningful analysis to student investigations. This sort of learning helps build an understanding of the connections between human development and the environment as well as a sense of community between classrooms and citizen scientists.

Student collects data in Chesapeake Bay area. Photo courtesy of National Geographic Education

Using FieldScope in the Chesapeake Bay

The Chesapeake Bay Foundation (CBF) is an organization that strives to educate citizens about the health of the Chesapeake Bay and its watershed, and to provide ideas and solutions for pollution mitigation and ecological recovery. During outdoor education classes, it is common for students to learn how to collect water quality data and photos in their fieldwork activities. FieldScope gives its teachers a chance to use students' collected information about water quality by uploading it onto a platform where student observations can be compared to and analyzed with observations from other schools and organizations throughout the Chesapeake Bay watershed. This type of learning provides a rich geographic context that allows students to gain a better understanding of how their lifestyles are connected to the bay. Seeing where their homes are in relation to nearby waterways helps students visualize how their land use affects water quality. When students upload their water quality data onto FieldScope, they can see how their data compares to that of their peers and scientists through spatial patterns. Students can turn on and off certain layers to visualize different features around the bay and how they interrelate. Using tools such as the flow path tool, the watershed tool, and query tool, students can examine other spatial patterns. For those teachers who want to teach their students about the history of the bay, there is a layer that displays points containing data about the Chesapeake in 1607 and now.

GIS tools are useful for visualizing spatial patterns and performing data analysis. Unfortunately, some GIS programs are expensive, difficult to use, and may not provide a collaborative sharing platform. FieldScope allows for students, teachers, and organizations all over the Chesapeake Bay watershed to share data and to use

geospatial data analysis tools for free. Through teacher trainings, professional development workshops, and online webinars, environmental and outdoor educators in the Chesapeake Bay community learn to utilize FieldScope as a way to inform students about the health of the bay and to emphasize the importance of being a citizen scientist.

"I use FieldScope because it has information that is pertinent to the material I cover in my program. I also enjoy that it is user friendly and a great visual."

Jocelyn A. Tuttle, environmental field educator, Chesapeake Bay Foundation

Beyond FieldScope, there are many other examples of instructional materials and tools that integrate geospatial technologies into the learning experience. *Investigating Your World with My World GIS: A Collection of Guided Inquiry Exercises for Explorers of All Ages* introduces teachers and students to a variety of applications of GIS software in social studies and science. The My World GIS™ software was designed specifically for education, making spatial analysis and mapmaking intuitive for students. Activities in the collection were developed by a group of authors who are both active curriculum developers and users of the software in K–12 and higher education. The set of activities was designed to span a range of curricular areas and grade levels and to use the unique features

Participants work with FieldScope. Photo courtesy of National Geographic Education

of the software to help students learn key content and practice spatial problem solving.

Students can use National Geographic Education's MapMaker Interactive (natgeoed.org/mapmaker), an online mapping tool, to learn mapping and GIS concepts and manipulate rich layers of information from local to global scales. Students can explore geographic data layers featuring themes such as water, land, climate, populations and culture, and human-environment interactions. They can use drawing and measuring tools, labels, and markers to create and customize a variety of map views, any of which can be easily saved and shared.

These are just a few examples of programs or materials that are widely available for classroom use. Other programs and materials that are being used in classrooms and informal learning environments, and incorporate geospatial technologies, include

- Esri Education Community at http://edcommunity.esri.com/, including extensive instructional materials and tutorials at http://edcommunity.esri.com/im/index.cfm
- Google Earth at http://sitescontent.google.com/google-earth-for-educators/
- Google Lit Trips at http://www.googlelittrips.org/
- Esri Storytelling maps at http://storymaps.esri.com/wordpress/
- National Atlas at http://www.nationalatlas.gov
- World Mapper at www.worldmapper.org
- Earth Explorer at http://earthexplorer.usgs.gov
- Social Explorer at http://www.socialexplorer.com
- Bud Burst at http://neoninc.org/budburst/educators/index.php
- Frog Watch at http://www.aza.org/frogwatch/
- BioKIDS at http://www.biokids.umich.edu/
- Gapminder at www.gapminder.org
- Modern Language map at http://www.mla.org/map_main
- Geospatial Revolution Videos at http://geospatialrevolution.psu.edu/

Educative Curriculum

Recommendation 4: Design instructional materials to be learning tools for teachers.

For the better part of our educational history, the design and implementation of instructional materials has focused on supporting *student learning*. Developers provide guides to help the teacher navigate features in the materials, but for the most part, the idea of designing instructional materials to support *teacher learning* is not at the forefront of developers' plans.

Some developers and educators may question why we should pay attention to teacher learning when designing instructional resources. Is not the goal of instructional materials to improve overall student achievement? While this is certainly the case, we also know that effective student learning from materials depends in large part on how teachers use the materials. Research shows that instructional materials, as they are designed, often differ from the curriculum actually taught to students (e.g., Ball & Cohen, 1996; Brown & Edelson, 2003; Brown, 2009; Remillard, 1999, 2005). This is referred to as the enacted curriculum—the curriculum that plays out in the classroom once the teacher has made adjustments to the curriculum as written in the materials (the intended curriculum). While curriculum developers hope that teachers will faithfully implement materials, in reality, teachers often make adaptations, and these adaptations do not always align to the intent of developers (Miller & Krumhansl, 2009).

Given the importance of teachers in shaping what students learn, it makes sense that curriculum developers should pay more attention to how teachers are enacting the curriculum. More recently, some developers have proposed design features to support teacher learning from the materials. These features are not simply step-by-step instruction manuals, or "how-to guides" for using materials. Instead, developers are beginning to think more deeply about the process of teacher learning, and they are designing features specifically for this purpose. As Ball and Cohen (1996) explain, "Rather than conceiving the curriculum as 'something for students' and the teacher's guide as merely an instruction manual for teachers, both would have to be considered as terrain for teacher learning" (p. 8). Teacher learning is a complex process of building and integrating knowledge of the discipline with knowledge of teaching practice and student learning (Davis & Krajcik, 2005). Given such complexity, designing instructional materials to be educative for teachers is no simple task. This requires developers to step outside their comfort zone and take a new look at the purpose and goals of materials design.

The following list includes components that could be included in geography instructional materials to make them educative for teachers. This list is synthesized from recent research examining the development and use of educative curriculum, primarily in the areas of science and mathematics education (Ball & Cohen, 1996; Davis & Krajcik, 2005; Remillard, 2005):

Educative Curriculum

As Davis and Krajcik (2005) explain, the word "educative" in educative curriculum refers to the teacher as the learner. Educative curricula are materials with the goal of improving teachers' knowledge in specific instances of instructional decision making, while also helping teachers develop more general knowledge they can apply flexibly in new situations (Davis & Krajcik, 2005, p. 3). Educative materials include components designed intentionally to support teacher learning. The educative components go well beyond what we see in traditional teacher guides that accompany textbooks and other instructional materials. Educative curriculum materials include elements that enhance teacher understanding of the content and of how to use materials for different purposes and in different contexts.

- **Content knowledge:** Educative curriculum should include supports to improve teacher content knowledge of geography that goes well beyond the level of understanding expected from students *(see Recommendation 5 for a discussion of teacher content knowledge).*
- **Student thinking:** Educative curriculum should include supports to help teachers listen to and interpret what students say in response to activities in the curriculum and to better understand student thinking in geography more generally *(see Recommendation 2 for a discussion of student thinking).*
- **Developmental perspective:** Educative curriculum should include supports that help the teacher understand how learning progresses for students in the context of learning geography over the course of the year or years *(see Recommendation 1 for a discussion of learning over time).*
- **Temporal perspective:** Educative curriculum should include supports to help teachers integrate the vision of the geography materials across a school year. For example, developers should provide a clear rationale and justification for particular sequencing of activities *(see Recommendation 1 for a discussion of strategic sequencing of materials).*
- **Transparent design process:** Educative curriculum should include sufficient information about the rationale guiding the design of the geography materials to inform teachers in their enactment decisions.
- **Design capacity:** Educative curriculum should include supports to assist teachers as they adapt and implement geography materials, so that the core essence of the materials is retained even while the materials are customized for the local classroom context.

We discuss four of the six features of educative curriculum in other recommendations, and thus will not repeat the argument in support of these features here. Two of the six features, however, are not described in other sections of the report and so we make the case for each one below.

Transparent Design Process

For the most part, the design of instructional materials has remained hidden from the educators who implement them. This is especially true for textbooks and other scaled-up instructional materials. While these resources make suggestions to teachers about strategies to use in the classroom, there often is little to no explanation about the rationale for using those strategies. It is up to teachers to judge when and how to follow suggestions from developers. As Davis, Beyer, Forbes, and Stevens (2011) explain, "Some teachers make productive changes to curriculum materials that support and enhance the intent of the materials while other teachers—for example, those who do not deeply understand the rationales behind reforms promoted in materials—make unproductive changes or fail to make changes to the materials that would benefit their students" (p. 797). Describing the underlying assumptions guiding the design of materials to teachers can provide much needed guidance as teachers make decisions and adapt materials to their classrooms.

Transparency in the design of instructional materials involves communicating to educators the underlying assumptions guiding design and the rationale for including particular methods, strategies, and other features in the materials. For example, if formative assessment is a critical component in the materials, teachers need to have a clear understanding of what constitutes formative assessment, how these assessments can be used to understand student thinking and to make instructional decisions, and they need clear indicators of when these assessments occur in the materials. Likewise, as described in Recommendation 1, developers need to provide a clear rationale for why particular activities are included in the materials and suggestions for what teachers can skip, add, or modify based on student progress and on constraints they may face in their classrooms.

Many developers find that the process of co-designing materials with practitioners leads to more successful implementation of materials in the classroom (Fishman, Marx, Best, & Tal, 2003; Morris & Hiebert, 2011; Penuel, Roschelle, & Shechtman, 2007; Voogt et al., 2011). Penuel et al. (2007) define co-design as "a highly facilitated, team-based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realize the design in one or more prototypes, and evaluate each prototype's significance for addressing a concrete educational need" (p. 53). This means that teachers do not simply provide feedback on a completed design, but instead are deeply involved in the design process from start to finish. Given teachers' wealth of knowledge and experience working with students, and working with the constraints of local classroom contexts (e.g., limited funds and time, large class sizes, and diverse student needs), their perspective is valuable at every point in the design process. The process of co-design helps both

the developers and practitioners come to a realistic understanding of what is possible, which leads to a better alignment with respect to the overall intent of the materials and the learning goals for students.

Design Capacity

Teachers *will* and *should* adapt materials to meet their students' and classroom needs. The act of teaching, therefore, also can be seen as an act of curriculum design. Depending on the teacher's level of control over the curriculum, and on their experience in the classroom, some teachers may have a high degree of design capacity when it comes to the enacted curriculum. The education research community refers to this as pedagogical design capacity, which is, "A teacher's ability to employ personal resources as well as resources embedded in the materials themselves to make productive changes to curriculum materials" (Davis et al., 2011, p. 797). Design capacity depends a great deal on whether teachers productively integrate new and innovative instructional materials with their own existing resources. In some cases teachers may become attached to a particular way of teaching a topic and resistant to trying something new, even if new methods or strategies are potentially beneficial for student learning. This teacher would have limited design capacity because the teacher is favoring existing resources and ignoring new resources that could improve their teaching and their students' learning.

A teacher with a high degree of design capacity continues to utilize existing resources for "what works" because these are proven successful in the classroom, but this teacher also recognizes that instructional materials can offer new and innovative approaches, and therefore are valuable resources as well.

Given that teachers have varying degrees of design capacity, developers can support teachers by making clear the core essence of materials. This helps teachers see the potential benefits of using new materials. The core essence of the materials—whether the materials are centered on a big idea in geography, or an innovative approach to geography instruction, or both—should be retained even as teachers adapt materials. Developers can anticipate some of the potential adaptations, and help teachers prioritize what to retain in the enacted curriculum (Barab & Luehmann, 2003). For example, if an activity calls for using technology to teach a geography concept, developers might suggest "low-tech" options to accomplish the same goal so teachers do not eliminate the activity altogether if access to technology is limited. An example of this would be layering transparencies showing different mapped data on an overhead projector as a "low-tech" option to displaying animated GIS mapping on an interactive whiteboard.

Conclusions

This Committee believes that designing materials to promote teacher learning is necessary to achieve our vision of high-quality materials in the classroom. As Shulman (1990) explains, "The essential value of curriculum is how it permits teachers to adapt, invent, and transform it as they confront the realities of the classroom" (p. x). The design of high-quality instructional materials today requires materials to be learning tools for teachers, providing necessary support in the continuous curriculum design process useful for day-to-day instruction. Adding educative components to instructional materials and working with practitioners to co-design materials are notable ways to foster greater communication between the developers and the implementers of instructional materials—and such communication will ultimately benefit students' learning of geography.

Recommended Reading

Ball, D. L., & Cohen, D. K. (1996). Reform by the book: What is—or might be—the role of curriculum materials in teacher learning and instructional reform? *Educational Researcher, 25*(9), 6–8, 14.

Miller, J. S., & Krumhansl, R. (2009). Learning from innovative instructional materials and making them your own. In J. Gess-Newsome, J. A. Luft, & R. Bell (Eds.), *Reforming secondary science instruction.* Arlington, VA: NSTA Press.

Research on Educative Curriculum

The notion that instructional materials should be educative for teachers, in addition to being educative for students, is a relatively new concept in instructional material design. The central role of teachers in shaping curriculum places them at the crux between curriculum developers and students. While teachers deserve a greater voice in the process of curriculum design, we also must recognize that teachers will be learners when it comes to understanding and implementing new instructional materials. Ball and Cohen (1996), among others, advocate for more dialogue between teachers and curriculum developers. They propose several practical solutions to produce educative curriculum for teachers, including features that help teachers

> (1) better understand student thinking in relation to the content, (2) improve their own understanding of the content, (3) conceptualize the development of content across time, and (4) recognize the strengths and weaknesses in the instructional materials in meeting learning goals.

Others have proposed that teachers also should be supported in making adaptations to the materials—adaptations to meet the needs of the classroom context, but ones that do not diminish the overall intent of the materials (Davis & Krajcik, 2005; Davis et al., 2011). As Penuel, Gallagher, and Moorthy (2011) explain, "designers must acknowledge and plan for the fact that teachers will and must adapt curriculum to fit their local classroom context" (p. 1000). This same point was argued several years earlier by Remillard (2005), who explained that designers need to shift from a focus on the fidelity of their own intentions and instead focus on designing tools teachers can use when implementing materials. Research has shown that if designers do not consider teacher adaptation, it is likely the designers' intentions will be undercut when teachers implement materials in their classrooms (Davis & Varma, 2008). Including educative supports will benefit all teachers, but especially new teachers who rely a great deal more on these supports compared with veteran teachers with years of experience (Grossman & Thompson, 2008). Given that teachers are making real-time instructional decisions across the school day, the inclusion of educative components in materials could support teachers in making more effective decisions. For example, drawing teachers' attention to critical components of instructional materials may prevent them from making decisions that go astray from the original intentions of the materials.

When developers provide teachers with effective resources, teachers then become invaluable assets for shaping change through the use of innovative materials. Given their wealth of classroom experience and their unmatched skill at making real-time instructional choices, they are capable of not only promoting a developer's vision, but actually improving its potential. Researchers have referred to this as pedagogical design capacity—a teacher's capacity to enhance the learning experience and craft effective teaching moments using their experience, personal resources, and the resources from developers (Brown & Edelson, 2003; Brown, 2009; Davis et al., 2011). Developers can learn a great deal from teachers—for example, how they enact curriculum in certain ways and why they modify, add to, or delete from instructional materials. Teachers are the on-the-ground eyes for observing what is most effective for student learning, and developers should take advantage of this source of knowledge when designing materials.

Recommended Research Reading

Ball, D. L., & Cohen, D. K. (1996). Reform by the book: What is—or might be—the role of curriculum materials in teacher learning and instructional reform? *Educational Researcher, 25*(9), 6–8, 14.

Brown, M. W. (2009). The teacher-tool relationship: theorizing the design and use of curriculum materials. In J. T. Remillard, B. Herbel-Eisenman, & G. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 17–36). New York: Routledge.

Davis, E. A., & Krajcik, J. (2005). Designing educative curriculum materials to promote teacher learning. *Educational Researcher, 34*(3), 3–14.

Davis, E. A., Beyer, C., Forbes, C. T., & Stevens, S. (2011). Understanding pedagogical design capacity through teachers' narratives. *Teaching and Teacher Education, 27*(4), 797–810.

Remillard, J. T. (2005). Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research, 75*(2), 211–246.

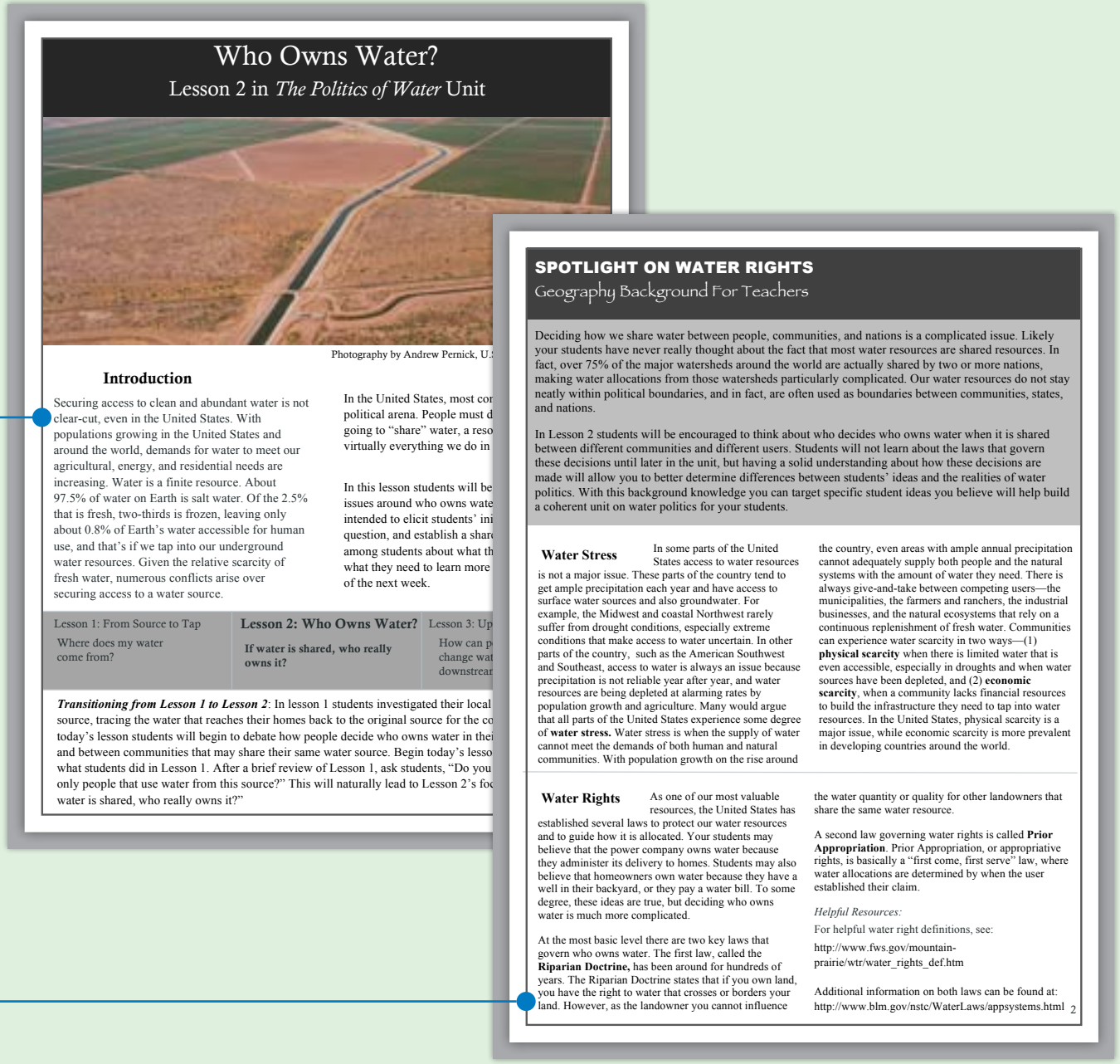
Geography in Practice

Features of Educative Curriculum

The following example shows snapshots from a teacher's guide for a unit on water politics. The snapshots illustrate several educative features described in Recommendation 4 that could be built into individual lesson plans across entire units.

Including a lesson overview helps the teacher see what he or she has covered so far with students, and where the coming lessons are headed. Suggestions for making the transition between lessons can help the teacher build a coherent unit that is more aligned with the designers' intentions.

After the introduction to the lesson, the curriculum designers provide additional content background for teachers. The content background goes well beyond the content expected from students in the lesson. Content background can build a sense of confidence in teachers who are uncertain of their own understanding of the content, and it can help teachers gauge where student understanding is in relation to accurate content.



Who Owns Water?

Lesson 2 in *The Politics of Water* Unit

Photography by Andrew Pernick, U.S

Introduction

Securing access to clean and abundant water is not clear-cut, even in the United States. With populations growing in the United States and around the world, demands for water to meet our agricultural, energy, and residential needs are increasing. Water is a finite resource. About 97.5% of water on Earth is salt water. Of the 2.5% that is fresh, two-thirds is frozen, leaving only about 0.8% of Earth's water accessible for human use, and that's if we tap into our underground water resources. Given the relative scarcity of fresh water, numerous conflicts arise over securing access to a water source.

In the United States, most cor political arena. People must d going to "share" water, a reso virtually everything we do in

In this lesson students will be issues around who owns wate intended to elicit students' ini question, and establish a shar among students about what th what they need to learn more of the next week.

Lesson 1: From Source to Tap	**Lesson 2: Who Owns Water?**	Lesson 3: Up
Where does my water come from?	**If water is shared, who really owns it?**	How can p change wat downstrear

Transitioning from Lesson 1 to Lesson 2: In lesson 1 students investigated their local source, tracing the water that reaches their homes back to the original source for the co today's lesson students will begin to debate how people decide who owns water in thei and between communities that may share their same water source. Begin today's lesso what students did in Lesson 1. After a brief review of Lesson 1, ask students, "Do you only people that use water from this source?" This will naturally lead to Lesson 2's foc water is shared, who really owns it?"

SPOTLIGHT ON WATER RIGHTS

Geography Background For Teachers

Deciding how we share water between people, communities, and nations is a complicated issue. Likely your students have never really thought about the fact that most water resources are shared resources. In fact, over 75% of the major watersheds around the world are actually shared by two or more nations, making water allocations from those watersheds particularly complicated. Our water resources do not stay neatly within political boundaries, and in fact, are often used as boundaries between communities, states, and nations.

In Lesson 2 students will be encouraged to think about who decides who owns water when it is shared between different communities and different users. Students will not learn about the laws that govern these decisions until later in the unit, but having a solid understanding about how these decisions are made will allow you to better determine differences between students' ideas and the realities of water politics. With this background knowledge you can target specific student ideas you believe will help build a coherent unit on water politics for your students.

Water Stress In some parts of the United States access to water resources is not a major issue. These parts of the country tend to get ample precipitation each year and have access to surface water sources and also groundwater. For example, the Midwest and coastal Northwest rarely suffer from drought conditions, especially extreme conditions that make access to water uncertain. In other parts of the country, such as the American Southwest and Southeast, access to water is always an issue because precipitation is not reliable year after year, and water resources are being depleted at alarming rates by population growth and agriculture. Many would argue that all parts of the United States experience some degree of **water stress.** Water stress is when the supply of water cannot meet the demands of both human and natural communities. With population growth on the rise around the country, even areas with ample annual precipitation cannot adequately supply both people and the natural systems with the amount of water they need. There is always give-and-take between competing users—the municipalities, the farmers and ranchers, the industrial businesses, and the natural ecosystems that rely on a continuous replenishment of fresh water. Communities can experience water scarcity in two ways—(1) **physical scarcity** when there is limited water that is even accessible, especially in droughts and when water sources have been depleted, and (2) **economic scarcity**, when a community lacks financial resources to build the infrastructure they need to tap into water resources. In the United States, physical scarcity is a major issue, while economic scarcity is more prevalent in developing countries around the world.

Water Rights As one of our most valuable resources, the United States has established several laws to protect our water resources and to guide how it is allocated. Your students may believe that the power company owns water because they administer its delivery to homes. Students may also believe that homeowners own water because they have a well in their backyard, or they pay a water bill. To some degree, these ideas are true, but deciding who owns water is much more complicated.

At the most basic level there are two key laws that govern who owns water. The first law, called the **Riparian Doctrine,** has been around for hundreds of years. The Riparian Doctrine states that if you own land, you have the right to water that crosses or borders your land. However, as the landowner you cannot influence the water quantity or quality for other landowners that share the same water resource.

A second law governing water rights is called **Prior Appropriation**. Prior Appropriation, or appropriative rights, is basically a "first come, first serve" law, where water allocations are determined by when the user established their claim.

Helpful Resources:

For helpful water right definitions, see:

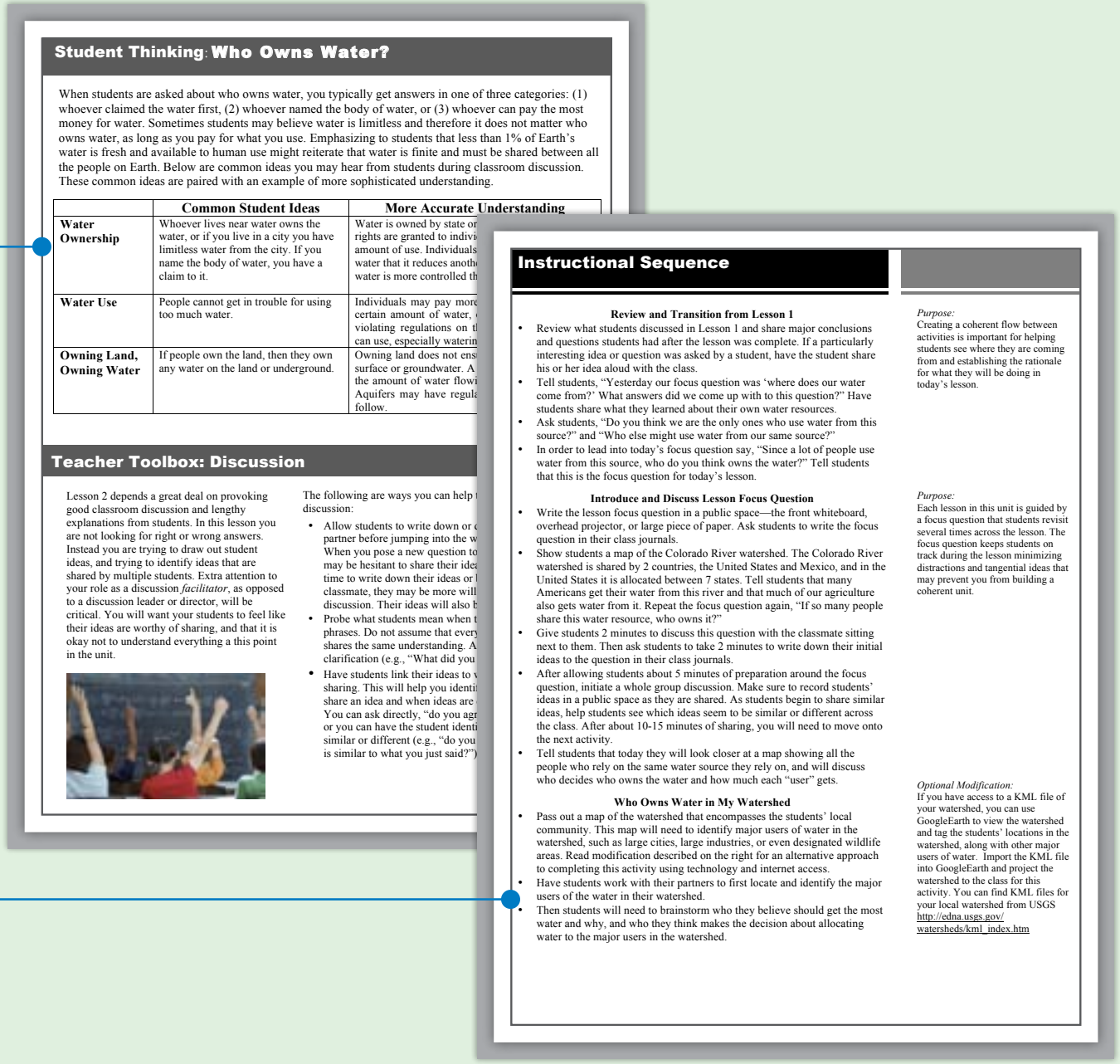
http://www.fws.gov/mountain-prairie/wtr/water_rights_def.htm

Additional information on both laws can be found at:

http://www.blm.gov/nstc/WaterLaws/appsystems.html 2

Before beginning the lesson, the designers point out information to build the teachers' pedagogical content knowledge. These are (1) expectations for student thinking during the lesson, and (2) the critical role discussion will play in the lesson. Pointing these out to the teacher helps the teacher see that today's lesson is about listening to students' ideas during discussion to better understand where students are beginning the unit.

In addition to providing step-by-step directions for completing the lesson, the designers also share a "purpose" for each step and a "modification" that some teachers may prefer to do instead of the regular activity. The inclusion of these features makes the design of the lesson more transparent to teachers, allowing the teachers to see what is intended with each activity.



Student Thinking: Who Owns Water?

When students are asked about who owns water, you typically get answers in one of three categories: (1) whoever claimed the water first, (2) whoever named the body of water, or (3) whoever can pay the most money for water. Sometimes students may believe water is limitless and therefore it does not matter who owns water, as long as you pay for what you use. Emphasizing to students that less than 1% of Earth's water is fresh and available to human use might reiterate that water is finite and must be shared between all the people on Earth. Below are common ideas you may hear from students during classroom discussion. These common ideas are paired with an example of more sophisticated understanding.

	Common Student Ideas	More Accurate Understanding
Water Ownership	Whoever lives near water owns the water, or if you live in a city you have limitless water from the city. If you name the body of water, you have a claim to it.	Water is owned by state or rights are granted to indivi amount of use. Individuals water that it reduces anoth water is more controlled th
Water Use	People cannot get in trouble for using too much water.	Individuals may pay more certain amount of water, violating regulations on t can use, especially waterin
Owning Land, Owning Water	If people own the land, then they own any water on the land or underground.	Owning land does not ens surface or groundwater. A the amount of water flowi Aquifers may have regula follow.

Teacher Toolbox: Discussion

Lesson 2 depends a great deal on provoking good classroom discussion and lengthy explanations from students. In this lesson you are not looking for right or wrong answers. Instead you are trying to draw out student ideas, and trying to identify ideas that are shared by multiple students. Extra attention to your role as a discussion *facilitator*, as opposed to a discussion leader or director, will be critical. You will want your students to feel like their ideas are worthy of sharing, and that it is okay not to understand everything a this point in the unit.

The following are ways you can help discussion:

- Allow students to write down or partner before jumping into the w When you pose a new question to may be hesitant to share their idea time to write down their ideas or classmate, they may be more will discussion. Their ideas will also b
- Probe what students mean when t phrases. Do not assume that every shares the same understanding. A clarification (e.g., "What did you
- Have students link their ideas to sharing. This will help you identi share an idea and when ideas are You can ask directly, "do you agr or you can have the student identi similar or different (e.g., "do you is similar to what you just said?")

Instructional Sequence

Review and Transition from Lesson 1

- Review what students discussed in Lesson 1 and share major conclusions and questions students had after the lesson was complete. If a particularly interesting idea or question was asked by a student, have the student share his or her idea aloud with the class.
- Tell students, "Yesterday our focus question was 'where does our water come from?' What answers did we come up with to this question?" Have students share what they learned about their own water resources.
- Ask students, "Do you think we are the only ones who use water from this source?" and "Who else might use water from our same source?"
- In order to lead into today's focus question say, "Since a lot of people use water from this source, who do you think owns the water?" Tell students that this is the focus question for today's lesson.

Purpose:
Creating a coherent flow between activities is important for helping students see where they are coming from and establishing the rationale for what they will be doing in today's lesson.

Introduce and Discuss Lesson Focus Question

- Write the lesson focus question in a public space—the front whiteboard, overhead projector, or large piece of paper. Ask students to write the focus question in their class journals.
- Show students a map of the Colorado River watershed. The Colorado River watershed is shared by 2 countries, the United States and Mexico, and in the United States it is allocated between 7 states. Tell students that many Americans get their water from this river and that much of our agriculture also gets water from it. Repeat the focus question again, "If so many people share this water resource, who owns it?"
- Give students 2 minutes to discuss this question with the classmate sitting next to them. Then ask students to take 2 minutes to write down their initial ideas to the question in their class journals.
- After allowing students about 5 minutes of preparation around the focus question, initiate a whole group discussion. Make sure to record students' ideas in a public space as they are shared. As students begin to share similar ideas, help students see which ideas seem to be similar or different across the class. After about 10-15 minutes of sharing, you will need to move onto the next activity.
- Tell students that today they will look closer at a map showing all the people who rely on the same water source they rely on, and will discuss who decides who owns the water and how much each "user" gets.

Purpose:
Each lesson in this unit is guided by a focus question that students revisit several times across the lesson. The focus question keeps students on track during the lesson minimizing distractions and tangential ideas that may prevent you from building a coherent unit.

Who Owns Water in My Watershed

- Pass out a map of the watershed that encompasses the students' local community. This map will need to identify major users of water in the watershed, such as large cities, large industries, or even designated wildlife areas. Read modification described on the right for an alternative approach to completing this activity using technology and internet access.
- Have students work with their partners to first locate and identify the major users of the water in their watershed.
- Then students will need to brainstorm who they believe should get the most water and why, and who they think makes the decision about allocating water to the major users in the watershed.

Optional Modification:
If you have access to a KML file of your watershed, you can use GoogleEarth to view the watershed and tag the students' locations in the watershed, along with other major users of water. Import the KML file into GoogleEarth and project the watershed to the class for this activity. You can find KML files for your local watershed from USGS http://edna.usgs.gov/watersheds/kml_index.htm

Teacher Knowledge

Recommendation 5: Develop and implement professional development programs that enrich teachers' knowledge of contemporary geography and how to teach it.

For teachers to be successful, they must possess many kinds of knowledge, including knowledge about the specific needs of learners in their classrooms, knowledge of the curricula that drive classroom instruction and assessment, and knowledge of the educational settings and mandates in which their classrooms are placed. But there are two core types of knowledge that teachers need to design and carry out meaningful learning experiences for their students: content knowledge and pedagogical content knowledge.

To teach geography well, teachers must have a deep knowledge of the discipline and the knowledge of how to teach specific big ideas and practices in geography so that students develop deep disciplinary understandings. But teachers of geography most likely were prepared to teach other content areas and do not have rich understandings of geography concepts and how to teach them. In most schools, geography is taught as part of other social studies or science disciplines; in elementary schools, geography also may be integrated into reading and writing activities. For many reasons, geography typically is not the primary subject-matter in which teachers were educated, which in many cases means their knowledge of geography and how to teach it is limited. Furthermore, knowledge of geography and how to teach it is not static but changes as disciplinary knowledge develops over time. This notion of disciplinary change is captured in our use of the descriptor of geography as "contemporary." The geography described in this report is not the same as geography practiced in the past. And we acknowledge that the field of geography will continue to change over time.

This means that content-focused opportunities for professional development in geography are essential—even for teachers with adequate preparation in geography—at the outset of and throughout their teaching careers. These opportunities should focus on enhancing teachers' knowledge of geography and how to teach it, and they should give teachers the opportunity to do geography themselves. Our Committee recommends that professional development programs for geography teachers focus on developing two core types of knowledge:

- **Teacher content knowledge.** Programs should include geography content to prepare teachers for skillful instruction within the discipline.
- **Pedagogical content knowledge.** Programs should improve teachers' understanding of instructional strategies and methods proven most effective at engaging students in learning specific geographic big ideas and practices.

Teacher Content Knowledge

We know from research on subject matter preparation that strong teacher content knowledge can have a positive impact on student learning (e.g., Ball & McDiarmid, 1990) and that student learning will suffer if teachers have little preparation in the discipline (e.g., Hashweh, 1987; McDiarmid, Ball, & Anderson, 1989). There is a widely recognized need for professional development that conveys to teachers the power and relevance of geography and its educational potential for all students (e.g., Morgan & Lambert, 2005).

Elementary teachers explore the local environment with science coordinator and park rangers to learn how people use this land. Photo courtesy of California Geographic Alliance

Professional development situated within the subject-matter context is more likely to have an impact on teacher knowledge and practice than general pedagogical professional development (Birman, Desimone, Porter, & Garet, 2000). Effective professional development should provide opportunities for teachers to delve deeply into the big ideas and practices of contemporary geography, expanding their content knowledge beyond a level of understanding expected from students

and, above all, inspiring them to be lifelong learners of geography. Teachers of geography are members within the scholarly community of geography and are responsible for knowing the key concepts, principles, and structures within the discipline, and the ways in which the discipline comes to add or dismiss these. Teachers' knowledge of geography cannot be static—it should change and expand as the discipline of geography evolves. Furthermore, teachers' knowledge of geography will change over time as a result of their own life experiences with geography (Brooks, 2011).

In addition to focusing on geographic big ideas and practices, professional development should provide opportunities for teachers to use geographic tools and technologies (e.g., cartography, GIS, and remote sensing) to enhance how they can convey content to students. Teachers have been slow to adopt geographic tools for use in the classroom, and this can be attributed, in part, to the lack of awareness of how to use them effectively (Baker, Palmer, & Kerski, 2009; Bednarz & Bednarz, 2008; Kerski, 2003). To remedy this, professional development providers should give teachers opportunities to learn contemporary geography using the tools of the trade, making sure teachers walk away from professional development experiences feeling comfortable and confident at integrating those tools into their instruction.

Pedagogical Content Knowledge

Shulman (1987) asked, "How do teachers decide what to teach, how to represent it, how to question students about it and how to deal with problems of misunderstanding?" (p. 6). Shulman's question has been a common one for many educators and education researchers looking at subject specific teaching. During the past three decades, the idea of pedagogical content knowledge (PCK) has become a popular term for describing the knowledge needed to teach specific subject matter concepts and practices. PCK can be defined as "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (Shulman, 1987, p. 8). There are many

Technological Pedagogical Content Knowledge

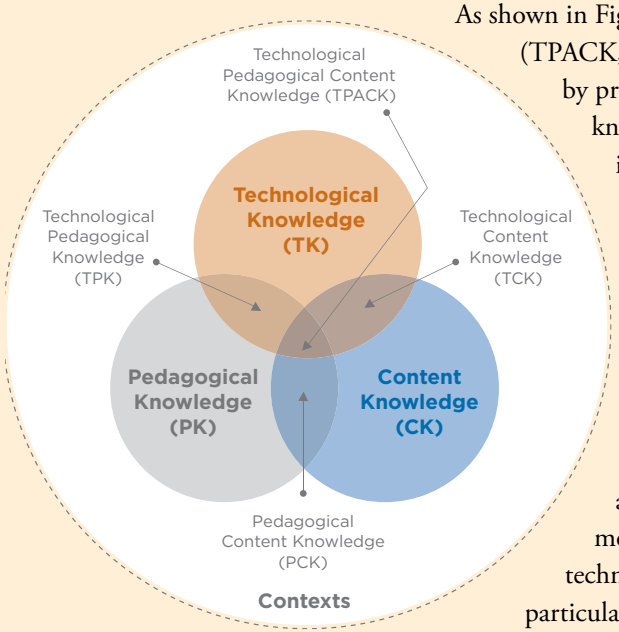


Figure 2. Adapted from TPACK.

Source: http://tpack.org

As shown in Figure 2, Technological Pedagogical Content Knowledge (TPACK, formerly known as TPCK) builds on Shulman's work by proposing a more complex, integrative model of teacher knowledge that unites content, pedagogy, and technology into a comprehensive framework (Mishra & Koehler, 2006). Technological knowledge, or the knowledge and skills necessary to utilize technologies, is not a separate kind of knowledge; rather Mishra and Koehler argue that technology and TPACK is inherently part of teachers' daily instructional decision making, particularly since technologies are now an integral part of classrooms. TPACK is important to geography teachers as they integrate geospatial technologies, such as web-based GIS, into their classrooms. Teachers need more than just functional competence using geospatial technologies. They need an in-depth understanding of how particular technologies can convey geographic big ideas to students, and how they can help students engage in geographic practices.

Recommended Reading

Mishra, P. K., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–54.

Technological Pedagogical Content Knowledge: www.tpack.org

aspects of PCK, but two primary components are: (1) knowledge of student learning in the discipline, and (2) knowledge of instructional representations (van Driel, Verloop, & de Vos, 1998). PCK moves beyond subject-matter knowledge and focuses on the purposeful, content-related decisions teachers make in designing or adapting instruction and in responding to student learning challenges in the moment.

Addressing PCK in professional development programs will help teachers develop the knowledge needed to anticipate, diagnose, and respond to common student patterns of understanding and misunderstanding about the most commonly taught geography big ideas and practices. With experience, effective teachers learn how to diagnose levels of understanding and misunderstandings, how to deal with them when they arise, how to ask the right probe and challenge questions, and how to handle student responses to those questions. Teachers with strong PCK become more aware of predictable patterns in student understanding of key geographic concepts; that scale, for example, is hard to comprehend and seasonal differences caused by the tilt of the Earth are difficult to explain accurately. Professional development should nurture the ability of teachers to allow student understanding to unfold over time when students' further exploration, and even struggles, are warranted.

Professional development that emphasizes pedagogical content knowledge also provides teachers with the opportunity to create multiple examples, memorable analogies, images, and representations of challenging topics so that they can make geography accessible to a wide range of learners. It should allow teachers to expand their repertoire of strategies, practices, and representations for making geography understandable. This is particularly important for addressing challenging topics such as seasonal change, scale, and map projections. Teachers should learn the strategies that are most effective for conveying geographic ideas and practices (e.g., place-based learning, fieldwork, inquiry, problem-based learning, etc.).

Conclusions

Professional development offers a key opportunity to improve teachers' knowledge of geography and how best to teach it. Teachers are part of the geography community, and they need to have a solid understanding of the structure and nature of the discipline. However, what separates teachers from geographers is their expertise in conveying disciplinary content to others, namely novice learners. It is not expected that teachers will be geography experts, but rather experts in organizing geography in an engaging way that emphasizes the big ideas and practices to students. Designing professional development that affords teachers the opportunity to improve their content knowledge of contemporary geography and geographic tools, and the teaching of those to students, is a key step in supporting teacher learning.

Recommended Reading

Ball, D., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389–407.

Doering, A., Scharber, C., Miller, C., & Veletsianos, G. (2009). GeoThentic: Designing and assessing with technology, pedagogy, and content knowledge. *Contemporary Issues in Technology and Teacher Education, 9*(3). Retrieved from http://www.citejournal.org/vol9/iss3/socialstudies/article1.cfm

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Fourth grade teachers share drawings of the Mojave Desert using inside-outside circles while learning effective teaching strategies to use with their students. Photo courtesy of California Geographic Alliance

Research on Teacher Knowledge

Shulman (1987) identified seven domains of teacher knowledge that spawned decades of research in teacher education and professional development:

> content knowledge, general pedagogical knowledge, curricular knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational ends, purposes, and values. (p. 8)

While identified separately, these domains of knowledge do not operate in isolation from one another. Davis and Krajcik (2005) propose an integrated view of teacher learning as

> developing and integrating one's knowledge base about content, teaching, and learning; becoming able to apply that knowledge in real time to make instructional decisions; participating in the discourse of teaching; and becoming enculturated into (and engaging in) a range of teacher practices … [Teachers] make connections between ideas, in addition to adding new ideas about subject-area concepts, instructional approaches, students' likely ideas, or teaching principles. And teachers need to apply their integrated knowledge flexibly to make decisions in real time and in widely varying contexts. (pp. 3–4)

It is now widely believed that teachers need to possess deep knowledge of the subjects they teach and continue to build this content knowledge throughout their careers. A teacher's knowledge of the subject matter not only plays a role in teaching practice, but also impacts student learning (e.g., Ball, 1991; Grossman, Wilson, & Shulman, 1989; Hashweh, 1987; McDiarmid, Ball, & Anderson 1989; Roth et al., 2011). However, while content knowledge has been deemed critically important, "the subject-matter preparation that prospective teachers currently receive is inadequate for teaching toward high subject-matter standards, by anyone's definition" (Wilson, Floden, & Ferrini-Mundy, 2001, p. 19). While we know that content knowledge is necessary for effective teaching practice, there are relatively few professional development studies that focus on content knowledge preparation of teachers (Garet, Porter, Desimone, Birman, & Yoon, 2001). This is particularly problematic for geography—a subject that few teachers study in depth as many typically major in other subject areas, such as history (Bednarz, Stoltman, & Lee, 2004). Clearly, enhancing geography content knowledge through professional development is a priority, but this also is an understudied area in geography education. Improving teacher knowledge of geography through professional development, however, will have obvious payoffs in the classroom, as teachers will not only feel more prepared to teach the content, but also will learn better ways to convey content to students (Ball, 1991).

In addition to being well versed in knowledge of the discipline, teachers find themselves in the unique position of communicating such knowledge to novice learners. Teachers must find a way to "unpack" complex disciplinary knowledge into something understandable for their students (Phelps & Schilling, 2004). Most research on pedagogical content knowledge has focused on characterizing and measuring this elusive construct (e.g., Ball, Thames, & Phelps, 2008; Baxter & Lederman, 1999; Brophy, 1991; Guyver & Nichol, 2004; Phelps & Schilling, 2004, Rowan et al., 2001). As Alonzo and Kim (2012) point out, "PCK is so embedded in particular instances of practice that teachers are often unaware of their use of this knowledge to make instructional decisions" (p. 2). This makes it especially difficult for researchers to measure PCK and for professional development providers to integrate PCK into their programs. Yet, even given difficulties in defining and measuring PCK, education researchers tout PCK as central to high-quality instruction. In part, this knowledge only develops over time as teachers experience many ways of conveying content and handling student struggles throughout this process. Professional development can, however, help teachers come to build their PCK, especially through creating communities of practice in which teachers, researchers, and professional geographers share their "tricks of the trade" with each other and experience "ah-ha moments" together (e.g., Wilson & Berne, 1999). Also see the section on "Professional Learning Communities" in Recommendation 6). For further discussion on teacher knowledge, see the research summary in Recommendation 3.

Recommended Research Reading

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389–407.

Brophy, J. E. (1991). *Advances in research on teaching: Teacher knowledge of subject matter* (Vol. 2). Greenwich, CT: JAI Press, Inc.

Grossman, P. L., Wilson, S. M., & Shulman, L. S. (1989). Teachers of substance: Subject matter knowledge for teaching. In M. Reynolds (Ed.), *Knowledge base for the beginning teacher* (pp. 23–36). Oxford, U.K.: Pergamon Press.

Geography in Practice

Professional Development to Improve Teacher Knowledge

In 2003, California passed a new law designed to infuse environmental education into all K–12 classrooms in the state, the Education and the Environment Initiative (EEI).* This vignette provides an overview of an innovative professional development program designed to carry out the mandated goals of this new legislation. Improving the environmental content knowledge and pedagogical content knowledge of science and social studies teachers was one of the chief concerns of developers of the model *Environmental Literacy Teacher Guide Series* discussed here. Given the diversity of the teacher-users of these guides, developers were forced to think "outside the box" about some of the most effective ways to design and deliver professional development to reach and teach the largest number of educators.

The *Environmental Literacy Teacher Guide Series* exemplify the fifth recommendation by:

- improving teacher content knowledge about environmental topics, and
- improving teacher pedagogical content knowledge about student thinking in the discipline.

Background on the Program

As a key part of carrying out the Education and the Environment Initiative (EEI), the state legislature allocated funding for the development and dissemination of a framework for "Environmental Principles and Concepts" and a "Model Curriculum." The goal of the Model Curriculum is to integrate the Environmental Principles and Concepts into science and social studies instructional materials through careful alignment to the existing state academic standards. The 85 curricular units created for this Model Curriculum span grades K–12. All materials are free and accessible to teachers online for use in helping students achieve mandated environmental literacy goals (although the Model Curriculum is not required for teachers or districts that prefer to use their own resources to achieve this goal).

During the development of the Model Curriculum, it became clear that the majority of California's teachers were underprepared to teach environmental concepts without professional development. Many teachers, especially those teaching in the elementary grades, lacked content knowledge, pedagogical content knowledge, and classroom experience for teaching environmental topics. One sixth grade teacher noted that when it comes to teaching climate change and other environmental issues, "There are many challenges teachers will face with the content. Many are unprepared for the tough questions students will ask."

To respond to this need, National Geographic Education Programs produced a series of four professional development guidebooks, the *Environmental Literacy Teacher Guide Series.* Each guidebook is accompanied by a set of videos teachers can use to reflect on classroom practice and student thinking. The four books focus on developing teachers' content and pedagogical content knowledge about key environmental areas noted in the California law—*Freshwater Resources, Ocean, Climate Change,* and *Energy Resources.* All of the guides and videos are housed on the National Geographic

Excerpt of Environmental Literacy Teacher Guide Series. Image courtesy of National Geographic Education

Education Programs' website and are free to download by teachers in California and across the country.**

Teachers point to the *Climate Change* guidebook as being especially helpful in making them more aware of what students already know about this controversial topic and how to approach instruction. A sixth grade social studies teacher noted that, "One thing I really enjoyed reading was the Student Thinking sections. This gives a teacher an idea of what students might be thinking. That way they can prepare themselves for what questions might be asked."

Design Considerations

The goal of the *Environmental Literacy Teacher Guide Series* is to improve both teacher's content knowledge and their pedagogical content knowledge about environmental concepts, especially those that are particularly challenging for students to understand. The guides are not intended to train teachers to use the Model Curriculum or to specify the instructional resources and teaching methods for conveying environmental content. Instead, these guidebooks are designed to increase teachers' confidence in their ability to teach new content and skills and their "comfort level" dealing with and anticipating what students might bring to the learning experience.

After careful reflection and discussion, developers decided that it was essential to communicate all of the information in these guides in a self-directed format due to funding constraints posed by more traditional on-site professional development approaches. As a result, most of the information contained in the guidebooks is presented in text-based readings, although text-linked video reflection activities also are interspersed throughout the guide. The following are the key components included in the guides:

- **Content knowledge:** Guidebooks include roughly 80 to 100 pages on one of the following four environmental topics: climate change, ocean, freshwater resources, or energy resources. Each guide is divided into chapters to help teachers navigate different subtopics. Content background included in the guides was determined by looking at the big ideas in the discipline and related academic standards and curricula. The content background was written at a level to be read by an educated adult with no formal training on the topic. One teacher said that the, "language and reading level would be easy for teachers of all experience levels." While the selected content was closely connected to topics taught in schools, the level of content went well beyond that normally presented to students and some teachers said that sections of the guides were "technical" to read. For example, special Case Studies explored specific topics in more depth, such as a detailed examination of the role of plankton in the ocean or why climate scientists study ice cores and tree rings.
- **Student thinking:** Student thinking was described in depth in each guide to help teachers anticipate some of the most challenging concepts for students to master. These descriptions of student thinking were integrated into the content background text. For example, as teachers read about ocean currents, they also read about some of the most common student ideas and perceptions related to this topic. Each guide also included a section featuring Student Thinking reflection activities. One activity type was based on a matrix comparing common inaccurate student ideas with accurate disciplinary ideas. Another type of activity included a classroom scenario featuring a question posed to students along with actual student responses to the question. Teachers were then asked to reflect on what students did and did not understand and how instruction might respond to the students' thinking. Including both types of Student Thinking activities seemed to be beneficial

Excerpt of Environmental Literacy Teacher Guide Series. Image courtesy of National Geographic Education

because some teachers noted that the matrix comparing student ideas with accurate ideas was "by far more helpful," while others noted that the "actual student responses gave insights to what students will be thinking."

- **Video reflection:** An additional activity, Pictures of Practice, also is included in the guidebooks. The goal of these video reflections is to improve teachers' pedagogical content knowledge. Each book contains twelve two- to five-minute long videos captured in California classrooms of teachers using their own instructional resources to conduct classroom discussions and student interviews that reveal many student misconceptions. During video reflection activities, teachers watch the video and reflect on how they might respond to student ideas if they were the teacher in the classroom who heard students sharing these ideas aloud.

Trade-Offs in the Design

There are important trade-offs in the design of the *Environmental Literacy Teacher Guide Series* that may decrease their effectiveness. For example, some might argue that self-directed professional development of this kind is less promising than immersing teachers in an on-site, facilitated professional development experience, such as the experience described in *Geography in Practice: The National Teacher Leadership Academy* (Recommendation 6). While this is likely true, given the constraints of implementing professional development for all teachers across a large state and no funding to support facilitation, the developers of the guides realized that most teachers would not have access to a facilitated experience. The widespread use of guides would likely happen only if they were provided at no cost and were easily accessible online.

Other notable trade-offs came to light during pilot studies of the program with a small sample of teachers. Key trade-offs of most relevance to developers interested in designing programs with similar focus on improving teacher knowledge are:

- **Level of content to include:** When designing a professional development program to target teacher content knowledge, developers must decide on the starting point of teacher participants: How much do teachers already know about the content, and to what level do we want to take them? Novice teachers with up-to-date coursework may bring more content knowledge to the professional development experience, for example, but this also might be true for veteran teachers who have continued to pursue formal and informal professional development during their careers. The pilot studies revealed that even teachers with a significant content base may hold some of the same misconceptions as the students in their classes. Thus, comparing these common misconceptions to more accurate information was important for all of the teachers involved. Primary grade teachers usually were more eager to be exposed to new content background than were middle and high school teachers, because they openly acknowledged their lack of content understanding. It is important for developers, therefore, to realize that teachers at different grade levels and with varying amounts of experience may need more or less content background for different reasons. Therefore, determining how deeply to delve into content and how to contextualize content knowledge in relation to classroom teaching depends largely on the target teacher audience.
- **Types of reflection activities and videos:** The pilot studies also provided evidence that there were marked differences in how novice and veteran teachers responded to student thinking and video activities, intended to enhance pedagogical content knowledge. Novice teachers preferred reflection activities that provided illustrations of effective teaching and accurate disciplinary information. In particular, this group felt that videos demonstrating effective teaching and videos of professional geographers and scientists would be more helpful than videos of students sharing misconceptions in the classroom. One first-year middle school teacher noted that, "I'm not getting the importance of paying attention to student thinking. Am I missing something?" Veteran teachers, on the other hand, tended to be more interested in reflecting on student misconceptions because they felt ready to wrestle with the challenges that come when confronting these misconceptions in the classroom. A veteran fifth grade social studies teacher commented that student thinking activities, "seemed quite strong because they had quotes from students. It gives teachers something concrete to think about and respond to... As a teacher it would be very helpful to understand where possible errors in thinking or misconceptions might occur so lessons can be structured in a way to have students 'discover' their errors in thinking." Another sixth grade veteran teacher reflected on how a novice teacher might respond to the videos and said, "For novice teachers or teachers new to climate studies, it may be difficult to answer the discussion questions (with the videos) without more guidance." The difference

between novice and veteran teachers is an important consideration when determining how to present reflective activities intended to improve pedagogical content knowledge because novice teachers may need different supports from those provided to veteran teachers.

The *Environmental Literacy Teacher Guide Series* and lessons gained from the pilot studies provide valuable insights for professional development designers in thinking about designing experiences for improving teacher content and pedagogical content knowledge.

*More information about the goal and scope of the statewide California Education and the Environment Initiative is available at http://www.calepa.ca.gov/education/eei/.

**The Environmental Literacy Teacher Guide Series are available at: http://education.nationalgeographic.com/education/program/environmental-literacy-guides/.

Vision for Professional Development

Recommendation 6: Design and implement coherent and sustained professional development programs with clear and measurable goals.

Professional development should create excitement and curiosity for learning geography, and it should leave teachers eager and prepared to help students develop a rich understanding of geography's big ideas and practices. Professional development must recognize teachers as learners and secure their commitment to teaching the discipline over the course of their careers. To that end, we recommend that developers and providers recognize that continual growth of geography teachers is core to designing and implementing professional development programs.

Professional development in education is the ongoing process of learning new knowledge and skills in the art of teaching. Professional development comes in many shapes and sizes. It can take place face-to-face—by attending a summer institute or participating in a school-based book study, for example—or it can involve online platforms that allow for communication among teachers worldwide. It can be pursued by individuals or groups and may be situated within a school system's efforts or outside the formal K–12 structures. The quality of professional development depends less on these structural elements and more on how well the program engages teachers in thinking deeply about teaching and learning within the discipline and in diverse classrooms.

Professional development providers should think critically and creatively about how to target geography-specific content and pedagogical knowledge that engages teachers in reflective practice. Such programs should promote a meaningful and relevant learning environment for teachers that moves beyond the "one-shot" workshop approach to create a vision of professional development as a sustained process throughout a teacher's career. The aim of high-quality professional development in geography is to help teachers continually reflect on their current teaching so that they include research-based best practices tailored to meet the needs of their specific students and contexts. However, professional development that is overly focused on a new approach or perspective without considering current practices may meet resistance. Likewise, a program that addresses only current concerns or circumstances may aim too low and thus maintain the *status quo*. Professional development must operate in a way that supports an innovative vision *while simultaneously* meeting the current needs of teachers, schools, and communities. Finding the right balance and focus for professional development is a complicated and critical task.

We recommend using the following four guidelines for the design and implementation of coherent and sustained professional development programs in geography:

- **Articulate a vision.** Professional development should be guided by a vision of effective geography teaching and learning, and they should use a model based on a theory of teacher learning with clearly articulated goals and measurable outcomes.
- **Attend to needs, challenges, and constraints.** Professional development should attend to the needs, challenges and constraints of local teachers, schools, and communities, and programs should provide specific and usable approaches to bridge the gap between the vision for the professional development and reality in schools.
- **Thoughtful implementation.** Programs should develop a plan that clearly considers the logistics and requirements of implementing high-quality professional development in concordance with the program's vision and goals.
- **Sustainability.** Program developers should recognize that change is gradual and sometimes difficult in educational settings, and programs should provide for ongoing support and sustainable professional learning activities for teachers.

Articulate a Vision

Articulating a clear and coherent vision for professional development means identifying goals for student knowledge and practices in geography and then identifying research-based instructional approaches to achieve those goals. Articulating a vision also involves considering and designing the most effective ways to help teachers master these instructional approaches.

High-quality professional development is designed with an intentional, proven model of teacher learning. Approaches such as fostering a community of learners (as discussed in "Professional Learning Communities" below) and making explicit links between abstract concepts and concrete classroom practices are examples of high-quality professional development practices. By framing goals for teacher learning, educators and professional development providers can then choose models of professional development that support these goals. For example, if the vision of teacher learning is active and hands-on, then a model of professional development that incorporates fieldwork and/or the use of geospatial technologies might be a good option. Or, if the vision of professional development focuses more explicitly on student thinking about geographic concepts, then incorporating analyses of student work and classroom videos showing students engaged in discussions and learning activities would support this outcome.

Teachers are learners, and their knowledge of geography content, instruction, and student learning is continually changing. Clearly articulated learning goals for teachers are necessary for successful professional development programs. The learning goals for any professional development should be accompanied by measurable outcomes so that providers can evaluate the impact on teacher understanding and student learning. Not every professional development experience will necessarily be measured, but learning goals and outcomes should clearly define the purpose of the program and guide providers in choosing appropriate activities to accomplish those outcomes. For more on research and evaluation of professional development, see Recommendation 8 of this report.

Attend to Needs, Challenges, and Constraints

In considering the "what" and "why" of professional development, providers also should carefully consider the gap between the goals of the program and current practices in local classrooms, schools, and communities. This "gap" highlights the difference between the ideal encompassed in the vision of the program and the realities of everyday classroom teaching in geography, and includes the multiple variables and demands that a teacher juggles every day. When considering the current realities of geography education, professional development must attend to common challenges we see at present, including a dearth of geographic resources in schools and teachers' limited geographic knowledge and practices. The size of the target audience, their teaching experience, resource availability in classrooms and schools, technology access and challenges, and curricular structure are just a few examples of what providers

Teachers as Learners: Adult Learning

Professional development providers are as concerned about adult learning as classroom teachers are concerned about child or adolescent learning. Adult learning, however, differs substantially from the learning of young children. Research on adult learning provides valuable information to professional development providers. Teachers will bring a wealth of experience, as well as unique attitudes and dispositions, to professional development programs, and these should not be ignored. From work by Knowles (1984, 1980), Strick (2005), and Trotter (2006), we know that professional development providers have a lot to leverage from teachers during professional development, and a lot to consider as they design and implement programs. The following are important characteristics of adult learners synthesized from this research:

- **Experience:** As a person matures s/he accumulates a growing reservoir of experience that becomes an increasing resource for learning. Adult learners want to build on this knowledge base, so prior experience should not be ignored.
- **Readiness and orientation:** Adults become more eager to learn information that directly applies to their social roles and profession. There is a sense of immediacy in learning readily applicable knowledge, especially as it relates to problems and challenges the adult has encountered in their profession. Relevant and applicable information is key.
- **Motivation:** As adults mature their motivation to learn becomes more internal and centered on professional interests. Adult learners want to reflect on their own paths and pursuits, and they bring a sense of agency—or self-direction—in wanting to decide where they are headed in their future.

should consider as they design professional development programs. The design of the professional development program should emphasize coherence between the vision of geographic teaching and learning and the existing needs, and effective programs will address the inevitable gaps that occur.

Furthermore, professional development should include time to discuss with teachers and administrators how the program addresses the challenges teachers may face in implementing the vision, and why rising to these challenges is necessary and beneficial to teachers and their students. One goal of all high-quality professional development should be to foster dialogue about how their current individual and school contexts differ from the goals of the program and, further, to help participants plan for how the professional development will support them in attaining the goals given their circumstances. This approach enables all participants to understand the relevance of the program to improving their classroom instruction.

Thoughtful Implementation

To provide effective professional development, providers must consider a variety of logistical factors required for thoughtful implementation. The literature recommends that professional development

- be situated in the context of teachers' practice,
- focus on content knowledge and pedagogical content knowledge,
- focus on student thinking,
- include intensive and sustained learning activities,
- include active learning and collective participation,
- allow time for teacher reflection and collegial dialogue, and
- employ a model that will ensure that the vision and goals of the professional development can be met.

All of these factors have logistical implications. Providers must seek out funding and partnerships that can provide resources and support for meeting these characteristics of high-quality programs. Allocating ample time for learning activities and follow-up also is a key logistical consideration to ensure that teachers, geographers, and other partners have a chance to collaborate. The scope and depth of the concepts and practices that are the focus of professional development should be appropriately aligned to the timeframe, audience, and setting of the particular program. Providers also should carefully evaluate the advantages and disadvantages of face-to-face settings, online, and hybrid modes of delivery to ensure the best mode is selected given the circumstances. Finally, professional development providers must recognize that teachers might experience an "implementation dip" when trying new strategies in their classrooms (Fullan, 2001), and providers should develop an action plan for supporting teachers through the implementation process.

Online Professional Development

As technologies become increasingly advanced and widespread, we find more alternative modes of delivery for teacher professional development such as online courses, webinars, video case study, and discussion boards. Online professional development is seen by many as one mechanism to address a larger audience of teachers who might not be able to participate in face-to-face professional development due to constraints on distance, time, or funding (Davis, 2009). The e-learning environment continues to grow as school districts search for more cost-effective modes of delivery. However, just as with traditional professional development, there is limited research linking online professional development, teacher learning, and student achievement, which means there is little guidance on best practices for developing and implementing these programs (Brunvand, Fishman, & Marx, 2003; Dede et al., 2009; Fishman et al., 2001). Designing online learning environments can cost considerable time and money to ensure the platform is interactive and engaging to teachers, and to monitor the program for technical problems and usage. But the benefits to schools and teachers come in the way of flexibility, access, and reduced spending. In recent years, online professional development programs have focused on developing communities of practice, allowing teachers to have access to varying perspectives and expertise in a shared process of learning. (Vrasidas & Glass, 2004, p. 5–6)

Recommended Reading

Dede, C. (Ed.). (2006). *Online professional development for teachers: Emerging models and methods.* Cambridge, MA: Harvard Education Press.

Sustainability

Professional development literature has discussed the critical need for long-term, sustained teacher learning rather than short-term, episodic, or disconnected workshops. For authentic change in teacher knowledge and practice, professional development should allow teachers to reflect on their learning, implement new instructional strategies, and collaborate with outside experts and colleagues over the course of their careers. Teachers need time for questions and feedback as well as support to continue their learning. Professional development should include long-term plans for teacher growth and be readily adaptable to the changing needs of teachers as they develop expertise in geographic learning and instruction. Rather than viewing professional development as "skills training," providers should commit to long-term support of teachers building expertise in their profession.

Recommended Reading

Loucks-Horsley, S. (2003). *Designing professional development for teachers of science and mathematics.* Thousand Oaks, CA: Corwin Press.

Villegas-Reimers, E. (2003). *Teacher professional development: an international review of the literature.* Paris: UNESCO International Institute for Educational Planning.

Wei, R. C., Darling-Hammond, L., & Adamson, F. (2010). *Professional development in the United States: Trends and challenges.* Dallas, TX: National Staff Development Council.

Professional Learning Communities

Research shows that sustained professional development over a long period of time is critical to bringing about lasting improvement in classroom practice. As a result, professional learning communities have become increasingly popular in recent years. According to Hord (1997), professional learning communities provide teachers and administrators in a school the opportunity to continuously seek and share learning and then act on what they learn, and the "goal of their actions is to enhance their effectiveness as professionals so that students benefit." (n.p.)

Professional learning communities are viewed as a powerful professional development approach and a potent strategy for school change and improvement. First used in Peter Senge's (1990) widely read book, *The Fifth Discipline,* the terms *learning organization* and *learning community* referred to a collaborative approach to increase the capacity and strength of organizations and corporations "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together." (p. 3)

In the educational arena, a learning community most often refers to a collaborative group of teachers and administrators who work together continuously to engage in reflective inquiry related to teaching and learning. Attributes for successful school-based professional learning communities (see Hord, 1997) include:

- collegial and facilitative participation of the principal, who shares leadership—and thus, power and authority—through inviting staff input in decision making,
- a shared vision that is developed from staff's unswerving commitment to student learning and that is clearly articulated and consistently referenced in the community's work,
- collective learning among participants and application of that learning to solutions that address students' learning needs,
- peer visits and review of each teacher's classroom to provide feedback and assistance that supports individual and community improvement, and
- physical conditions and human capacities that support such an operation.

Recommended Reading

Roberts, S. M. & Pruitt, E. Z. (2003). *Schools as professional learning communities: Collaborative activities and strategies for professional development.* Thousand Oaks, CA: Corwin Press.

When designing, implementing, and sustaining professional development, providers and researchers have focused on features that are most engaging for teachers and most effective in changing their knowledge and practice to impact student achievement. According to Yoon, Duncan, Lee, Scarloss, & Shapley (2007), high-quality, effective professional development enhances teacher knowledge and skills, and this improves classroom teaching and, ultimately, student achievement. Research consistently identifies the following characteristics of high-quality professional development programs that improve chances for lasting change in teacher practice and student achievement:

- **Content focus:** Professional development that focuses on the specific content that teachers are expected to teach in classrooms is more effective than professional development that is generic in content.
- **Focus on student learning:** Professional development should focus on student thinking about concepts and help teachers anticipate and respond to student ideas. Programs should help teachers understand how students' ideas and experiences develop within the subject or around a concept, and then connect these ideas and experiences to the "big ideas" of the discipline.
- **Coherence:** The vision, learning goals, and activities of professional development should provide coherence for teachers to better understand the curriculum they are teaching, the strategies they are using, and the ways they are assessing student learning. Professional development should be connected to the curricular and pedagogical needs of teachers as opposed to being a set of "fun" activities. It is essential for effective professional development to be connected to state standards and assessments as well.
- **Long-term teacher learning:** The number of contact hours with teachers matters. Generally, the more time teachers have to immerse themselves in their own learning, the more effective the professional development will be in changing their knowledge and practice. And, just as important, effective professional development requires extended time to support teachers as they implement their learning in classroom contexts and to provide assistance when they encounter obstacles. Viewing teacher learning as long-term, over the course of teachers' careers, rather than as episodic workshops, is more likely to have a lasting impact on teacher knowledge and practice.
- **Collective participation:** Teachers should be provided with ample time to discuss their learning with colleagues and prepare for implementation in their classroom. It is best if several teachers from the same school are involved together so that they can continue learning from one another as they return to their classrooms.
- **Active learning:** Professional development that involves active learning is more effective, because it allows for meaningful discussions; chances to use content and tools in relevant ways (e.g., fieldwork, labwork, simulation); and opportunities to plan, practice, observe others, and adapt learning to specific classroom contexts.
- **Cost:** Professional development is a high-cost activity; Garet, Porter, Desimone, Birman, & Yoon (2001) estimates that high-quality professional development costs an average of $512 per teacher annually, which is more than twice what most distre[illegible]

The National Teacher Leadership Academy exemplifies the sixth recommendation by:

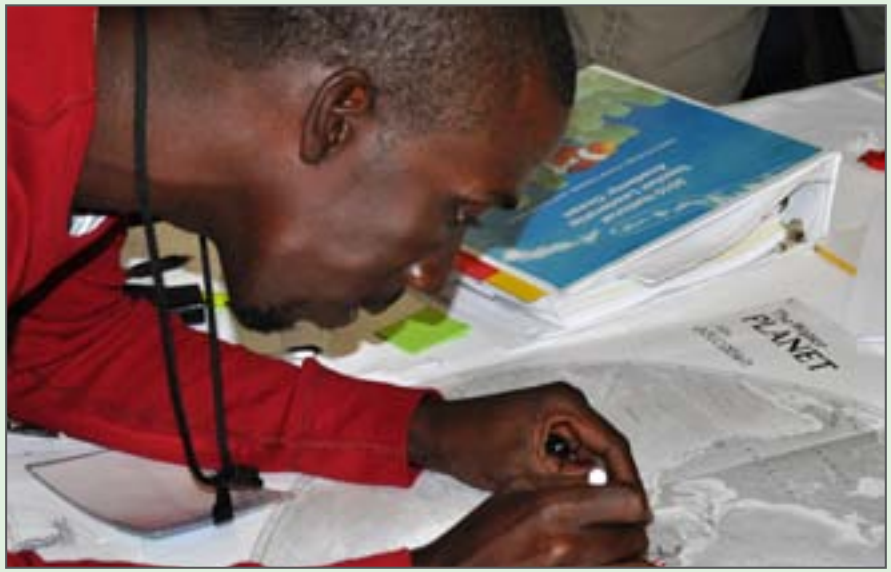
- establishing clear learning goals that were measured over time and through multiple modes, and
- sustaining professional development through an online community forum and resources, and additional professional development opportunities.

with each other, knowing that their mutual goal was to return to their schools to teach students about the concept that all of the world's water (fresh and salt) is part of a global system. "How do we get students to open their eyes up to the impact that they have, and how they are connected to oceans?" asked Katie Hoekzema, a ninth grade teacher from Colorado.

Katie's question motivated her and others to learn multiple ways of engaging students in exploring ocean-related concepts. She participated in hands-on lab activities to better understand ocean surface currents, thermohaline effects, and Albatross bolus dissections. She noted strategies and activities shared by others in her lab groups. "I'm always looking for better ways to reach my students," shared Scott Daniels. "I'm always looking for new ideas."

Teachers point to the Climate Change guidebook as being especially helpful in making them more aware of what students already know about this controversial topic and how to approach instruction. A sixth grade social studies teacher noted that, "One thing I really enjoyed reading was the Student Thinking sections. This gives a teacher an idea of what students might be thinking. That way they can prepare themselves for what questions might be asked."

NTLA participants. Photo courtesy of National Geographic Education



NTLA participant maps watersheds. Photo courtesy of National Geographic Education

Preservice Teacher Education

Recommendation 7: Enhance preservice teacher education programs to emphasize teaching geography across subjects and grade levels.

Teacher Quality Matters

Research shows that effective teachers are critical to improving student achievement (NRC, 2010a). Defining the qualities of effective teachers is not a simple task; however, the literature agrees that effective teachers have a strong foundation in content knowledge and pedagogical content knowledge, and effective teachers have the ability to improve student achievement through well-designed and implemented instruction that engages all students and monitors student progress toward learning goals (e.g., Stronge, 2007; NRC, 2010a). The fundamental question is: How do we prepare teachers to develop these qualities and support student achievement of geography wherever it occurs in the curriculum?

Much of the answer lies in exposure to a high-quality professional development continuum that begins with preservice education, is enhanced through induction or mentoring programs, and continues throughout a teacher's career with inservice education. This Committee firmly believes that a strong foundation for teaching geography across subjects and grade levels must be established in preservice education programs.

Preservice education in a college or university setting has long been a common requirement for most public school teachers. Such programs, however, have never been standardized, and teacher preparation varies depending on state credential guidelines and the specific requirements of colleges and universities. In recent years, the value of traditional teacher education preparation programs has been challenged, and numerous alternative pathways to certification provide options for entering the teaching profession. Traditional and alternative pathways vary in candidate selection criteria, program length and content, field placement preparation and requirements, and evaluation procedures. As a result, the approximately 200,000 new teachers who become certified in the United States each year (NRC, 2010a) enter the profession with mixed experiences. Thus, hiring newly credentialed teachers who demonstrate potential for success in the classroom will require careful attention to the nature of those experiences.

Imagine that you are advising someone who is planning to become a K–12 teacher and you must decide which credentialing program best prepares applicants for a career as an educator. Given the following choices, which program would you select?

> **Program 1** boasts collaboration among faculty to ensure that all students learn subject matter in relation to pedagogy through coursework, which includes readings, lectures, student research, discussions, and projects. Professors in discipline-based departments (e.g., Geography, Geological Sciences, Environmental Studies) communicate and coordinate with professors in the Teacher Education department to ensure that preservice teachers develop conceptual understandings about the disciplines they will teach in addition to the skills necessary for effective teaching, learning, and assessment of that discipline in K–12 classrooms
>
> **Program 2** promotes field-based learning through a series of K–12 classroom observations, practicum experiences, co-teaching, and then full-time student teaching. This university maintains strong ties with local schools and insists on placing preservice teachers in model programs with experienced and effective veteran teachers. Field placements are carefully considered to match preservice teachers with exemplary programs that demonstrate best practices in the subject areas for which the student is seeking credentialing. For example, a preservice teacher earning a credential to teach multiple subjects in the elementary grades would be placed in a classroom where geography content and skills are effectively taught and practiced in the social studies and science curricula. These field placements allow preservice teachers to observe, practice, co-teach, and ultimately become responsible for full-time teaching by the end of the program in several classroom settings.
>
> **Program 3** maintains a reputation for strong mentorship throughout its credentialing program. Students are matched with a mentor who has expertise in

Preservice teachers simulate the water cycle on a giant map of Oregon. Photo courtesy of Oregon Geographic Alliance

the subject area(s) and grade level(s) for which this preservice teacher seeks credentialing. Most mentors are based at the university, but some serve as administrators or mentor teachers in local school districts. Preservice teachers meet their mentors at the beginning of the program and maintain communications throughout the program. Mentors support students in understanding course-work, planning for instruction and assessment, and reflecting on their field placement experiences. Some mentors serve as university supervisors to facilitate this process of mentorship, and all remain active in their field demonstrating the importance of a career-long continuum for professional development.

These program choices are not mutually exclusive, and prospective teachers should not be faced with choosing between programs like the ones described above. A well-designed preservice teacher education program can and should incorporate the key elements of all three programs.

In this recommendation we focus on the importance of building proficiencies among geography educators in elementary and secondary schools. Because of the broad and interdisciplinary nature of geography, all geography, social studies, and science teachers (including elementary teachers who are responsible for multiple subjects) should enter the profession with an understanding of geography and know how to integrate learning and assessment of geography across the curriculum. Preservice education programs should provide the necessary teaching and learning experiences to ensure this for every new generation of teachers. Unfortunately, current teacher preparation programs lack emphasis on teaching geography in preparing both elementary and secondary teachers. Therefore, we argue that high-quality preservice education for prospective elementary teachers and for prospective secondary teachers in science and social studies fields should include:

- **Coursework in geography and subject matter teaching.** Teacher preparation programs should provide preservice teachers with a wide and balanced understanding of geography, help them to develop geographic perspectives and skills, and prepare them to teach students to use geographic thinking and reasoning effectively.
- **Field placements.** Preservice teachers should observe, inquire about, benefit from, and practice with the most effective models and examples of geography instruction during their field experiences, student teaching, and internship teaching experiences.
- **Mentoring.** Preservice teachers should have knowledgeable, experienced, and motivating mentors who support and guide their early teaching experiences in geography.

The three programs described earlier highlight the need to enhance preservice teacher education programs by incorporating key elements from *all three* of the guidelines listed above. Through well-planned and coordinated coursework, field placements, and mentoring, the qualities developed during preservice experiences should result in new teachers prepared to maximize geographic literacy for all students.

Coursework in Geography and Subject Matter Teaching

Geography educators have called for more geography-specific coursework for prospective teachers who intend to teach geography. In defining a highly qualified geography teacher, GENIP (2006) called for:

> [C]ontent preparation appropriate to the grade level in which they practice as professionals:
>
> 1. High School teachers should have successfully completed course work or the equivalent to a content major in geography (at least 30 credits).
> 2. Middle School/Junior High School teachers should have successfully completed course work or the equivalent to a content minor in geography (at least 15 credits).
> 3. Elementary School teachers should have completed course work or the equivalent of a minimum of three content courses (nine credits) introducing Earth's physical and human systems. (p. 1)

This Committee acknowledges that adding more coursework to teacher preparation programs is not the

only answer to the development of teachers' geographic knowledge, and it may be difficult for universities to implement such recommendations. However, courses can provide an important base in preservice teachers' learning. If programs lack the appropriate coursework to prepare teachers to teach geography, then change is necessary. We strongly urge programs to reconsider and revise the existing coursework requirements to better integrate geography content in preservice teachers' programs. This can occur within appropriate courses already in the program—such as courses in geography, social studies and science methods, and educational technology—in ways that will enhance the connections between geography content and geography pedagogy. This will help students make connections across courses and other program components such as field experiences and student teaching.

Field Placements

Field placements offer a valuable learning experience for preservice teachers, as they enable teachers to gain experience teaching while being supported by another teacher and their teacher education program. However, all too often teachers report that their field placements were not as beneficial as they hoped. For example, Bullock (2004) found a preservice teacher's implementation of technology was diminished by an unfortunate field placement:

> What was preventing her from gaining experience teaching with technology during her field placement? … "Unfortunately, my teacher teaches a little bit differently than I anticipate teaching. Mine would be more of an activity-based approach where you could use the computer lab more often because you're not always following the book and doing lesson-by-lesson, page-by-page. For that's how hers works, and technology doesn't fit in as easily." (p. 212)

To avoid the experience described above, field placements should be thoughtfully chosen to offer preservice teachers the chance to observe, plan for, instruct, and assess students' learning of geography. This is especially true for students placed in elementary settings, where geography, social studies, and science receive limited instructional time. This prevents many student teachers from ever seeing geography instruction happen in the classroom setting. Instead, preservice teachers should be placed in classrooms with exemplary geography teachers, or teachers who integrate geography into the teaching of other subjects, such as social studies, humanities, and/or science. These field placements should be useful in helping preservice teachers evaluate, reflect upon, and develop effective geography teaching practices.

Mentoring

In addition to well-designed coursework and field placements, all preservice teachers should be partnered with strong and committed mentors who support and coach them as they enter the profession. Mentors can provide feedback or guidance as preservice teachers become familiar with the curriculum, and as they develop and implement instructional activities. Positive peer-to-peer interaction is critical. Bednarz, Bockenhauer, and Walk (2005) recommend that "in order to move from early-career isolation to membership in a professional geography education community, novice geography educators need to talk openly with peers and to share ideas in non-judgmental environments" (p. 107). Mentors also can identify professional learning opportunities

Preservice teachers joined inservice teachers to develop an atlas and instructional plans for California students. Photo courtesy of California Geographic Alliance

(e.g., geography journals, conferences and meetings, workshops and institutes, online resources and webinars, social networking) and invite preservice teachers to become active members of appropriate professional organizations (e.g., state geography alliance, National Council for Geographic Education, state Council for Social Studies) or join special interest groups within professional organizations to support geography education across the subjects and grade levels.

Mentors need preparation to be effective. In developing the Geography Mentor Model, Bednarz et al. (2005) explain that mentoring can be complicated because teachers with several years of experience may be tempted to *tell* novice teachers how things need to be done, instead of guiding them through the process. Mentors need to learn how to guide new teachers and to understand that "mentoring is not about telling war stories; it is about developing collaborative, positive plans for action." (p. 109) Mentoring is a professional

relationship that values the expertise and needs of both the mentor and mentee in their shared pursuit of improving teaching and learning in geography.

Conclusions

This Committee believes that the most effective preservice teachers entering the profession are those who have learned and implemented effective geography instructional practices—wherever geography is found in the K–12 curriculum—through their preparation programs. This type of professional and academic foundation is highly desirable for entering the teaching profession. Professional development provides opportunities to further enhance these qualities over time with ongoing support from appropriate mentors and inservice programs. Therefore, policies and decisions about the required components of teacher preparation programs must be aligned with decisions about the practices that result in increased understanding of geography and effective teaching in this discipline. For example, coursework should help preservice teachers identify the big ideas in geography and learn how best to represent those ideas so that the subject matter is comprehensible to young and adolescent learners. Furthermore, preservice teachers need opportunities to observe the use of powerful analogies, illustrations, explanations, examples, and demonstrations in live classrooms with real students. Additionally, they should receive coaching and feedback as they plan, teach, and assess for student learning in geography. Overall, there must be meaningful connections across coursework, field placements, and mentoring. Each of these related components provides opportunities for preservice teachers to become effective teachers of geography and therefore all of these components should explicitly include geography-specific requirements for every prospective teacher who will be responsible for teaching geography—wherever it is taught.

Recommended Reading

Bednarz, S., Bockenhauer, M., & Walk, F. (2005). Mentoring: A new approach to geography teacher preparation. *Journal of Geography, 14*(3), 105–112.

Haycock, K., & Crawford, C. (2008). Closing the teacher quality gap. *Educational Leadership, 65*(7), 14–19.

Walsh, K., & Tracy, C. O. (2004). *Increasing the odds: How good policies can yield better teachers.* New York: National Council on Teacher Quality.

Research on Teacher Education

Teachers' qualifications, specifically their knowledge and skills, matter more for student learning than any other single factor (Darling-Hammond, 2001, 2006, 2010). These findings are supported by numerous other studies (e.g., Cochran-Smith, 2003; Haycock & Crawford, 2008; NRC, 2010a; Rice, 2003; Wenglinsky, 2000). The development of these qualifications, for most teachers, begins in their teacher preparation programs. Therefore, this recommendation is based on the current research on teacher preparation.

A recent study published by the National Research Council (2010a) addressed several key questions about teacher preparation in the United States. The study identified information about who enters teacher preparation programs, what type of instruction and experiences comprise their academic preparation, and the extent to which required coursework and experiences converge with scientific evidence. The study found that traditional teacher preparation programs are still the dominant route to becoming a teacher, but more than 130 alternative pathways were identified. An analysis of three different credential pathways concluded, "The pathway a teacher takes into the field has little to no effect on the contribution he or she makes to student learning" (p. 41). Therefore, we envision that all preservice teacher educators—in traditional or alternative pathways—will embrace the intent of this recommendation and devise plans within and across their program structure to best prepare new teachers of geography.

The domains consistently identified as important in teacher preparation include subject-matter knowledge, pedagogical and other professional knowledge, and field or clinical experiences (NRC, 2010a, p. 44). This recommendation calls for planned and organized attention to the teaching and learning of geography within and across each of these domains. Based on research on learning (including teacher learning), teacher education, and the influences of different contexts for learning, Darling-Hammond and Bransford (2005) developed a conceptual framework emphasizing three general areas important for any teacher: knowledge, skills, and dispositions. Geographic and pedagogical content knowledge, effective teaching skills, and appropriate dispositions for geographic learning do not belong in any one place in the preservice education program—they belong in all of those places. A coherent program that organizes coursework and field placements for preservice teachers to combine theory and practice is ideal (Darling-Hammond, 2001).

Because little published research focuses on geography teacher education, our review had to draw upon published accounts in other subjects, including mathematics, science, and reading. Although these conclusions are based primarily on research in other subjects, some recommendations for teacher preparation in geography do exist. Brooks (2011), for example, describes the effectiveness of geography education programs in England and Wales that emphasize the integration of geography content with pedagogical processes during coursework, as opposed to separating the two into different courses. Moreover, coursework that targets geography content and geography teaching methods should pay particular attention to the inclusion of geospatial technologies. Building confidence and a positive attitude toward such technologies is critical among preservice teachers, who will potentially utilize these technologies over the course of their teaching careers (Bednarz & Audet, 1999). While some programs do provide geography coursework for preservice teachers, it is much more common that preservice teachers will have limited preparation in the discipline. Thus a strong mentoring program in geography education is necessary to support new teachers entering the profession (Bednarz, Bockenhauer, & Walk, 2005). While we know that coursework, field placements, and mentoring are critical to prepare geography teachers, there is a need for more research in subject matter preparation for prospective teachers (Wilson, Floden, & Ferrini-Mundy, 2001), specifically in the field of geography.

In sum, this recommendation reflects our vision for teacher preparation programs to be cohesive, coordinated, and connected so that preservice teachers develop the necessary knowledge, skills, and dispositions to effectively teach geography.

Recommended Research Reading

Brooks, C. (2011). Geographical knowledge and professional development. In G. Butts (Ed.), *Geography, education and the future,* (pp. 165–180). London: Continuum International Publishing Group.

Bill & Melinda Gates Foundation. (2010). Learning about teaching: Initial findings from the measures of effective teaching project. Retrieved from http://www.gatesfoundation.org/college-ready-education/Documents/preliminary-findings-research-paper.pdf

Darling-Hammond, L. (2006). Constructing 21st century teacher education. *Journal of Teacher Education, 57*(3), 300–314.

National Research Council. (2010a). *Preparing teachers: Building evidence for sound policy.* Washington, DC: The National Academies Press.

Wilson, S. M., Floden, R., & Ferrini-Mundy, J. (2001). *Teacher preparation research: Current knowledge, gaps, and recommendations. A research report prepared for the U.S. Department of Education.* Seattle: Center for the Study of Teaching and Policy, University of Washington.

Geography in Practice

Learning to Become a Teacher of Geography

Jennifer Bowser is a sixth grade social studies teacher at Beaver Dam Middle School in Beaver Dam, Wisconsin. She graduated in 2006 from St. Norbert College in De Pere, Wisconsin, with a Bachelor's degree in Elementary/Middle School Education and a specialty in broad-field Social Studies. She earned a Wisconsin Department of Public Instruction grades 1–9 license. Her undergraduate teacher preparation program marked the beginning of her professional development continuum, which then led to a master's degree in professional development, and continues today with her active participation in the Wisconsin Geographic Alliance.

Ms. Bowser's teacher preparation exemplifies the seventh recommendation by:

- providing connected coursework in education and disciplinary studies, such as geography and science, to prepare preservice teachers for application in their field placements, and
- providing support and encouragement by mentors to implement methods, strategies, and tools and to participate in professional development programs, such as the state geographic alliance.

Jennifer (Jen) Bowser's introduction to teaching geography started during her freshman year of college. While taking content area courses in science, social studies, and geography, she also was learning to become a teacher through her education coursework. Jen appreciated this early "overlap" of courses that provided a foundation in her teacher preparation program.

By sophomore year, Jen was taking methods courses that included field studies and technology use. She recalls, "We learned how to use GPS in our methods class, and then our professor took us off site to learn how to teach science and use GPS in a nature reserve. That was huge and I saw connections to geography right away." As part of her "sophomore block" practicum that year, Jen was placed in a middle school classroom for five weeks and found it "cool to work with kids right away while figuring out how to be a teacher." She immediately began applying what she was learning in her methods courses and engaged students in map work. Jen was not afraid to use technologies, such as GPS, to enhance geographic learning through student projects. Because she was encouraged to apply what she was learning in her university coursework, Jen learned a lot about teaching and learning from her middle school students, as well as from her professors.

Jen took a human geography course to strengthen her social studies background, and during fall semester of her senior year, enjoyed her first student teaching placement in an eighth grade social studies classroom. "My supervising teacher, Mr. Ravissa, encouraged me simply to try my activity ideas—without knowing for sure what the results might be. So I had students working with maps, and we went to Fallen Timbers Environmental Center where we took time to integrate geography activities so they could have real learning experiences—just like I had in my own methods courses." While Jen's supervising teacher did not direct her to teach geography and did not necessarily model for her what and how he expected her to teach, he did allow her to figure out how she could maximize learning using the methods and strategies learned in her social studies methods class. "I gave the kids the tools they needed to learn—primary sources, maps, etc.—so they could figure out the answers rather than read from a book or have me tell them the answers. My professors had modeled and encouraged us to use technology and other materials with students, and to get them to learn outside of the classroom. Because I had experienced it myself in my classes, I knew the kids would enjoy using materials and technology, going outdoors, and learning through experiences. And they did."

With a growing desire to learn about another world region, including what education was like outside of the United States, Jen chose to complete her second student-teaching placement that fall in a foreign country—through the college's overseas student teaching program. She journeyed to Listowel, Ireland, and began a nine-week stint at Convent School, an all-girls school. She loved her placement there in a second-grade classroom. The first week she presented a colorful map of the world displayed on a shower curtain, to share with her students: "My second graders loved that! We used it every day and put Post-it notes all over the map. My students were fascinated to hear stories about

places in our country, and I enjoyed hearing them tell me stories using the map as well. It was cool to see their worldviews and perspectives, and I learned a lot of geography myself in these discussions. I learned about people and things I was experiencing there, that I had never heard about before." Jen recognized that her own worldview was limited, and that she had much to learn about education and about geography. "I guess I truly realized the value of teaching and learning geography." This experience motivated her to continue her path as an educator and to take control of her own professional development.

Jen traveled as much as possible while studying and teaching in Europe, and she wanted to learn more about the region. She returned to St. Norbert so excited about her experiences that she contacted geography professor Mark Bockenhauer and asked why more geography courses were not offered that semester. Dr. Bockenhauer offered to create an independent study course on the geography of Europe for Jen. While she was working on this independent course, Dr. Bockenhauer invited Jen to serve as a volunteer at the finals of the Wisconsin Geographic Bee. Jen's passion for geography and education were evident to Rich Brouillard, who was coordinating the event that year. Rich, who was principal of Beaver Dam Middle School, soon contacted Jen for a job interview. Jen was hired early that summer to start teaching sixth grade science in the fall of 2006.

In preparation for her new position, Jen participated in a professional development program during that first summer after graduation. Dr. Bockenhauer, the Wisconsin Geographic Alliance Coordinator, recommended that she participate in a geo-literacy workshop titled "Take Me With You: A Journey with Geography and Literacy." This weeklong professional development experience, led by alliance teacher-leaders, provided Jen with multiple instructional resources, standards-based teaching strategies, and a supporting network of teachers. She learned about the continuing opportunities of the Wisconsin Geographic Alliance and was convinced that she should continue taking workshops and classes to support her professional development. With immediate implementation of the resources and strategies learned through these programs, she added geo-caching and other integrated geography activities to her first-year sixth grade science curriculum.

Jen has since shifted to teaching sixth grade social studies at Beaver Dam Middle School, and she continues to work hard to enhance her teaching. She has completed several more professional development programs through the Wisconsin Geographic Alliance, including a weeklong summer geo-technology workshop, a "geo-fest" conference, and a workshop-presentation training that has prepared her to deliver geography professional development for educators through the alliance. Jen also completed a master's degree in education, focused on professional development. She has received a teaching award to enhance her classroom geography technology. Through her continued and active participation in her state geographic alliance, Jen now recognizes, contacts, and routinely works with like-minded educators committed to developing geographic literacy in the students of Wisconsin. The experiences with colleagues willing to share with and mentor her has been both directly helpful and truly motivating for this early-career teacher. Now in her seventh year as an educator, Jen realizes, "I cannot imagine not teaching."

Call for Research and Evaluation

Recommendation 8: Develop and fund extensive research and evaluation in geography instructional materials and professional development.

Instructional materials and professional development programs should be studied to determine what is working and not working within programs, and how varied program components contribute to improve teacher knowledge, practice, and student learning. For the purpose of this recommendation, we define research as a scholarly study or inquiry that seeks to advance a theory or knowledge of a topic. Evaluation, on the other hand, is a systematic decision-making process, using quantitative and qualitative data to determine whether a program achieved its anticipated goals. Both research and evaluation are vital tools for gathering empirical information about instructional materials and professional development. Circumstances in a given context may lend themselves to one more than the other, but both should be pursued to help create a research base, provide evidence, and inform decision making in geography education.

There are two parts to this recommendation. First, we call for the geography education community to engage in a strategic research agenda about instructional materials and professional development. By "strategic" we mean a research agenda where research questions are connected, focused, and where questions build upon the findings of previous studies, within geography education and related areas of study, to advance the knowledge in this field. We propose research questions (under "Research Directions") about instructional materials and professional development that need to be answered to advance our understanding of teaching and learning in geography. Secondly, we call for funding to support programs seeking to advance this agenda. Without funding, we hold little expectation that large-scale change will occur.

Strategic Research on Instructional Materials and Professional Development

To advance our understanding of student and teacher learning and the associated tools and strategies that support learning, the geography education community needs to build a solid foundation of research about both instructional materials and professional development. Through the extensive literature review conducted to generate this report, it became clear that there is limited research on geography education upon which to build our case. While we benefited from research in science education, social studies education, learning sciences, and psychology, it is critical for the field to pursue geography-specific questions.

This is not to say that the geography education community has been inactive. Unlike other disciplines, the geography education community has several large-scale, functional networks for disseminating instructional materials and professional development to teachers. The National Council for Geographic Education, for example, annually sponsors a national competition for grant funding for research projects in geographic education. It also has a Special Interest Group focused on encouraging research in the field. In addition, the National Geographic Alliance Network has footholds in every state, the District of Columbia, Puerto Rico, and Canada. The Alliance Network conducts regularly occurring workshops with teachers and continuously circulates new instructional materials to network members through face-to-face and virtual channels. Though the Alliance Network has been operating for decades, it has focused heavily on developing capacity among teachers and not on research and evaluation. Consequently there is much professional development activity but limited empirical research available on the effectiveness of these programs and materials. However, the Alliance Network is particularly well placed to operationalize and implement this recommendation. The community has many unanswered questions, and network participants could advance a research agenda.

In addition to proposing specific research questions under "Research Directions" on the following pages, this Committee also points to three promising areas for future research in geography education. These research areas have shown promise in other disciplines (e.g., math education, science education), and they could advance efforts in instructional material design and professional development in geography education.

- **Design-Based Research.** Design-based research is a research paradigm that studies learning in context, exhibiting the following five characteristics: (1) the design of learning environments is intertwined with the development of learning theories; (2) development and research take place through continuous cycles of design, enactment, analysis, and redesign; (3) the design work includes relevant implications and learning theories for practitioners and other educational designers; (4) the design work includes an account for how designs work in actual classroom settings; and (5) it uses methods that link processes of enactment to outcomes (Design-Based Research Collective, 2003, p. 5). Design-based research can be utilized to design new instructional materials, to redesign existing materials, or to develop professional development experiences for teachers. At the heart of this type of work is the iterative nature of the design process, where the research is used to better inform models for instructional materials and professional development, and where those models are tightly connected to the design program being tested.
- **Learning Progressions.** Learning progressions, a relatively new concept in education research, are grounded in frameworks for how student thinking in a domain develops over time, how educators can tap into this thinking through well-designed assessments, and how we can improve student learning given carefully crafted instructional resources. Learning progression research in geography would not only fill gaps in what we know about students' geographic thinking but would also connect knowledge about student thinking to the design of instructional materials. Calls for research on learning progressions have been made by several education entities, including the National Assessment Governing Board (2006), the National Research Council (2007c, 2012), and the Consortium for Policy Research in Education (Corcoran, Mosher, & Rogat, 2009; Mosher, 2011).
- **Technology Tools.** Given the rapid advances in technology over the past decade, the opportunities to make use of technology tools in instructional materials and professional development have great potential. Geography is well positioned to utilize and integrate technology tools to enhance students' experiences of geographic phenomena, especially with new resources in geospatial technologies. Technology tools can be integrated into instructional resources (1) to simulate and model geographic phenomena, (2) to assist students in collecting and analyzing geographic data, and (3) to allow students to communicate geographic information at local or global scales. As geography education research moves forward, capitalizing on the research possibilities around technology-based tools will be central to advancing our knowledge base about how best to integrate the tools of geography into the classroom.

Funding and Support for Research in Geography Education

Establishing research programs that are supported by federal and private funding is not a simple task. Researchers need to articulate a clear vision for their research, an appropriate plan of action, and measurable outcomes, in order to draw conclusions that are of value to the larger community. An important component to building a healthy research program is establishing collaboration across diverse members of the geography community so that a broad-based understanding of the current knowledge base is established. This type of collaboration is appealing to funders who look for research programs that take advantage of expertise across the community.

Research programs should recognize that expertise is found in many places within the community, and collaboration across these experts is critical (see Recommendation 9 for more on collaboration). Furthermore, to build a robust research community focused on teaching and learning in geography, this Committee believes the following three conditions must exist:

1. Geography education needs to be recognized as a legitimate area of scholarship by the larger academic geography community, and thus worthy of consideration for the promotion and tenure for scholars pursuing this line of work.
2. Research programs should emphasize support of early career scholars in developing research-based programs on instructional materials and professional development.
3. The geography community should support publication outlets that publish peer-reviewed articles with a focus on research in geographic education and related fields.

The three conditions described above must be met to fully support the geography education community in active, sustained research agendas that have the capacity to attract adequate funding for multi-year research projects. The larger geography community needs to place a higher priority on research in geography education to demonstrate that geographers not only value educational research, but also recognize the critical role education plays in developing citizens and future geographers.

In addition to meeting these three conditions, the geography education community also will need to actively pursue funding to support rigorous research programs on instructional materials design and professional development. Funding is essential to maintaining a research program in geography education. While other school subjects have received a steady stream of federal funding for research, geography education has not. In science, engineering, and math education, we have seen decades of NSF-funded programs, including the Centers for Learning and Teaching (CLT), the Research and Evaluation on Education in Science and Engineering (REESE) programs, the Discovery Research–K12 (DR–K12) programs, and Math-Science Partnership (MSP) programs, among others. This steadfast support for advancing science, math, and technology education has paid off, resulting in a substantial corpus of research to inform instructional materials and professional development and a growing community of researchers and developers. There have been no similar large-scale investments in research-focused projects in geography education, but funding streams to support geography education research are necessary to advance the field.

Conclusions

The outcomes of research on the design of instructional materials and professional development during the past few decades played a significant role in guiding the recommendations compiled in this report. When possible, we drew from geography-specific educational research, but, due to the limited body of research accomplished to date in geographic education, it also was necessary to consult the findings of scholars in other related fields. To fill the gaps in the existing research base and to advance our understanding of best practices in geography education, geography educators need support and funding to pursue strategic research agendas on instructional materials and professional development.

Recommended Reading

Bednarz, S., Heffron, S., & Huynh, N. T. (Eds.). (2013). *A road map for 21st century geography education: Geography education research* (A report from the Geography Education Research Committee of the Road Map for 21st Century Geography Education Project). Washington, DC: Association of American Geographers. Retrieved from www.natgeoed.org/roadmap

Design-Based Research Collective (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32*(1), 5–8.

Research Directions for Instructional Materials and Professional Development in Geography

Research in geography education has been limited primarily to small-scale studies of short duration with limited systematic data collection and analysis. While these types of studies have their place within every discipline, the geography education community urgently needs a strategic research agenda in instructional materials and professional development that includes a range of studies, the results of which are cumulative. We are in particular need of large-scale, long-term, systematic investigations into teacher and student learning in geography. We propose the following key research areas and questions for further study:

Student Thinking in Geography

It became very clear throughout this committee process that we need more research on student thinking in geography. We especially need research on how students come to understand the big ideas and practices in geography. This knowledge will enable us to better understand how to design instructional materials around what students bring to the classroom and how to support students in making progress toward more sophisticated understanding. In particular, we propose the following research questions about students' geographic thinking:

- What are the naive ideas and common misconceptions students bring to the geography

classroom? Which of these can teachers build from, and which are potential barriers to learning more sophisticated geography content?

- How does student thinking develop around specific geographic ideas or practices at different developmental stages?
- How can student thinking in geography be cultivated over time with careful instruction?
- How do students use geographic thinking in their daily decision making? Does having a geographic lens improve student thinking in other subject areas and, if so, how?

Design and Use of Instructional Materials and Tools

Instructional materials need to be grounded in an effective model for geography learning. Designers of instructional materials must be thoughtful about choosing how, when, and what to convey to students and how to make their intentions known to teachers. In addition, designers must learn how teachers enact materials to identify what works and does not work in the reality of the classroom. We propose the following research questions about geography instructional materials:

- How can knowledge about student thinking and learning in geography help us design and implement better instructional materials and tools?
- How can instructional materials be designed to support teachers in moving from teaching geography as a fact-based discipline to teaching around big ideas and practices?
- How do teachers use and modify geography instructional materials? In particular, how do teachers determine instructional resources to use with students, and what factors influence this decision making?
- In terms of impact on student learning, what are the best strategies and methods for engaging students with particular geographic content?
- What theories of models of geographic learning are most fruitful for guiding the design and implementation of effective materials in the classroom?
- How do teachers integrate geospatial technologies and other geographic tools into teaching? Does using these geographic tools improve student understanding of big ideas and practice?

Teacher Knowledge and Practice

Many teachers of geography are under-prepared to teach geography content, having little or no education in geography themselves. A key to transforming the geography classroom is having a better understanding of teachers' content knowledge and pedagogical content knowledge and understanding how this knowledge influences practice in the classroom and student learning. The following research questions would improve our understanding of teacher knowledge:

- When do teachers learn geography? What sources support the development of teacher content knowledge, particularly other than higher education coursework?
- Does having a deep understanding of geography content and tools lead to more effective teaching in geography?
- How can we measure pedagogical content knowledge in geography and, more importantly, is pedagogical content knowledge linked to student achievement?
- How do teachers integrate geographic ideas and practices into other subject matter areas (such as science or social studies classes), and does this integration support students in making richer connections during learning?

Professional Development

Providing for long-term, sustained growth of teachers who are committed and active within their disciplines is essential to enabling teachers to implement the recommendations in this report. Throughout the committee process, we relied on the general professional development literature to inform our work. However, we propose several unanswered questions specific to professional development in geography:

- What professional development experiences lead to sustained growth of geography teachers? Are these experiences unique to teaching geography?
- What experiences foster commitment and a positive disposition in teaching geography, especially given that teachers of geography may be committed to teaching other disciplines as well?
- How can professional development support geography teachers in implementing materials or strategies in their own classroom context?
- What aspects of professional development have an impact on actual geography teaching practice and student learning?
- How can technology and online learning environments be used to broaden the impact of professional development while maintaining the integrity of the learning experience?

Research and Evaluation on Professional Development

Despite the need for research on professional development, "relatively little systematic research has been conducted on the effects of professional development on improvements in teaching or in student outcomes" (Garet, Porter, Desimone, Birman, & Yoon, 2001, p. 917; this is echoed by results found by Yoon et al., 2007). While school districts, state education agencies, foundations, and universities continue to devote time and financial resources to professional development of teachers, the enduring research questions remain: Do teachers gain knowledge in professional development? Does professional development change teacher practice? Does student achievement increase as a result of professional development? (Desimone, 2011).

Research and evaluation are key considerations in designing and implementing professional development programs. Guskey (2000) identified levels of research and evaluation of professional development programs:

1. Participant reactions (Did the teachers "like"the professional development?)
2. Participant learning (Did teacher knowledge change?)
3. Organizational change (Did professional development impact a school or organization?)
4. Participant use of new knowledge/skills (Did teacher practice change?)
5. Student learning (Did professional development impact student achievement?)

The geography education literature is replete with studies that address the first two levels of Guskey's model. But little is known about levels three, four, and five. To investigate the important connections linking professional development and student achievement, researchers must move beyond just asking teachers if they "liked" the professional development experience and focus more on investigating the impacts of the professional development experience on teacher knowledge, teacher practice, and student achievement.

Recommended Research Reading

Dede, C., Jass Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education, 60*(1), 8–19.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*(3), 181–199.

Guskey, T. R. (2000). *Evaluating professional development.* Thousand Oaks, CA: Corwin Press.

Yoon, K. S., Duncan, T., Lee, S. W-Y., Scarloss, B., & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues & Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from http://ies.ed.gov/ncee/edlabs

Need for Collaboration

Recommendation 9: Create opportunities for sustained and authentic collaboration among geographers, education researchers, and practitioners.

A broad range of individuals representing various academic fields and occupations have expertise in geographic education. Geography professionals, K–16 education practitioners, and learning researchers/developers play interrelated roles in creating quality instructional materials and professional development. Too often in creating instructional materials and professional development, the contributions of one key group or another are non-existent or merely symbolic. To promote the vision presented in this report, we encourage geographers, education researchers, and practitioners to collaborate in ways that are authentic and sustained throughout the development process—from inception to implementation, evaluation, and revision.

Geographers and Geography Professionals

Contemporary geography involves a broad range of practices that are integral to business, multiple academic disciplines, and broader social movements. Understanding the core tasks, tools, and knowledge of geographers and other geography professionals is critical to teaching and learning across subject areas in the K–12 curriculum. Accordingly, professional geographers play a critical role in defining and interpreting the discipline and how it relates to disciplinary studies for students and educators. Geographers can significantly contribute to the conceptualization of instructional materials and professional development for teachers, going well beyond serving as "guest speakers" or reviewers. To accomplish this, designers must clearly identify the roles of geographers within the design process and plan to integrate geographers throughout the process to benefit from their expertise. Geographers themselves must seek out opportunities to engage with K–12 developers and build their understanding of K–12 education, including standards and assessments. This will require a sustained effort to broker partnerships locally and through state and national networks.

Education Researchers and Developers

Education research and development professionals play a central role in conceptualizing, testing, and refining instructional materials and professional development for geography education. They can inform development work with research-based views of learners, development, and, where it is available, how learners come to understand core geography content and practices. They also can offer insights into how teachers come to learn geography and improve their teaching practice. They are critically important in the evaluation of programs, identifying how the materials succeed and fail in supporting both learners and teaching practice. Researchers and developers should play this evaluative role throughout the development process and not be relegated to a post-hoc evaluative role.

Education Practitioners

No meaningful change in geography education will unfold without the participation of education practitioners at every level of the system. Teachers, professional development providers, curriculum consultants, and school and district administrators are uniquely positioned to know the resources and constraints of students, schools, and local communities. These practitioners can inform the materials development process with known challenges that their teachers and students encounter in learning geography and knowledge about how state and local community interests and resources can be brought into the geography curriculum and learning environments. Practitioner knowledge is

"Learning by Interning" Intern contributes to water resource curriculum. Photo courtesy of STEMworks™

especially important in geography as there is limited publication of research on geography-specific student learning at present. In addition to their expertise in teaching and learning, practitioners play a critical role in brokering access to students, teachers, and schools to support field tests and refinement of new instructional materials and professional development.

Collaboration

We are calling for collaboration at multiple scales. On a local scale we imagine partnerships that serve the goals of an individual teacher, department, school, or district, and that result in a particular curriculum unit or teacher learning experience. On broader scales we envision networks of professional associations finding ways to mutually support geography education development. For example, geography societies may devote resources to foster these collaborations by organizing invited sessions at their annual conferences or special issues in their publications that foster the collaborative nature of instructional materials and professional development activities involving geographers, education researchers, development professionals, and practitioners.

Deep and sustained collaboration that permeates professional cultures will result in powerful instructional materials and professional development. Project-specific collaboration is a beginning step in enacting long-term change in the field, but it is insufficient. Geographers, education researchers, and practitioners need to develop a culture of collaboration that exists independent of grant-funded and time-delimited projects. Geographers need forums for understanding geography education; practitioners need forums for understanding the dynamic field of geography and how it pertains to the world beyond the school walls; and developers need access to both geographers and practice settings to meld designs with research. These forums will require significant resources to develop and sustain, including both funds and the commitment of individuals and groups across multiple professional communities.

Several regularly occurring events, processes, and publications within education and geography can be built upon to bolster these collaborative partnerships. At local, state, and national levels, educators engage in materials adoption processes, revise and review curriculum standards and assessments for geography and related subjects, address professional development needs, and plan instruction. All of these are rich opportunities in which geographers should be engaged. Similarly the regular meetings of education and geography associations can be venues for partnership development. Within these meetings special sessions dedicated to the intersection of geography and education can build awareness and fuel collaboration. We may further facilitate shared knowledge and collaboration through publication. Geographers, education researchers, and practitioners can join forces to publish articles in journals and other periodicals describing collaborative endeavors and promoting the value of building instructional materials and professional development that integrate distinct expertise from multiple perspectives.

Recommended Reading

Linn, M. C., Songer, N. B., & Eylon, B. S. (1996). Shifts and convergences in science learning and instruction. In R. Calfee & D. Berliner (Eds.), *Handbook of educational psychology* (pp. 438–490). Riverside, NJ: Macmillan.

Radinsky, J., Bouillion, L., Lento, E. M., & Gomez, L. M. (2001). Mutual beneficial partnerships: A curricular design for authenticity. *Journal of Curriculum Studies, 33*(4), 405–430.

Rosen, E. (2007). *The culture of collaboration.* San Francisco: Red Ape Publishing.

Solem, M., Foote, K., & Monk, J. (2012). *Practicing geography: Careers for enhancing society and the environment.* Upper Saddle River: Pearson Education, Inc.

Clean Energy Teacher Training – classroom hands-on wind turbine activity.
Photo courtesy of STEMworks™

Geography in Practice

AP Human Geography

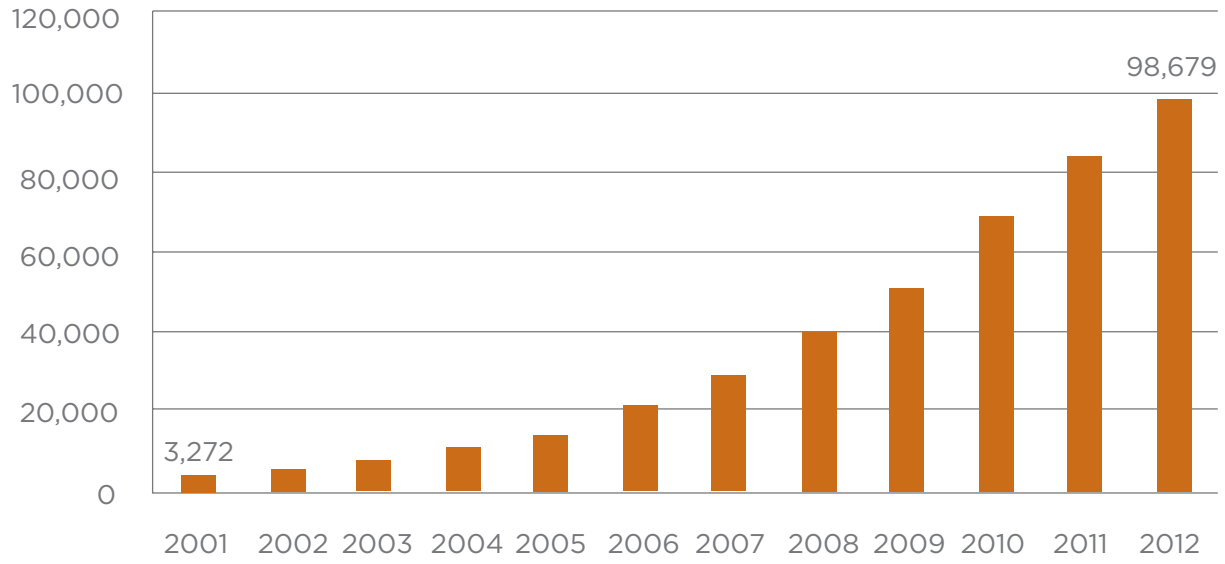
The development and dissemination of an Advanced Placement Human Geography (APHG) course in the United States provides a remarkable and enduring success story of the power of collaboration among K–12 educators, academic geographers, and professional organizations in geography during the past decade. APHG has experienced staggering growth rates since its approval by the College Board and subsequent implementation in high school classrooms across the United States beginning in 2000. The story of its development, approval, and dissemination nationally, therefore, provides an excellent example of precisely the kind of sustained and authentic collaboration among geographers and educators called for in this section of the Road Map Project report.

Creating a new APHG course for high school students in the United States was a long and arduous process that began in the mid–1990s when representatives from professional organizations in geography presented their bold vision for a new AP offering in geography to the College Board. These geographers convinced the College Board to appoint a group of geography faculty and classroom teachers to serve on an exploratory committee charged with making a recommendation for an AP geography course. Drawing upon surveys and input from members of the larger geography community, the committee ultimately recommended the development of an introductory AP Human Geography course.*

The next step in making the APHG course a reality was the development of a content outline for a model introductory Human Geography course. Once the College Board approved the committee's proposed outline, work began on development of a question bank from which the first APHG exam was compiled and the new APHG course began to be offered in high schools across the country. Since its official introduction in the 2000–2001 school year, the number of students and teachers involved in APHG has grown so rapidly that it has been challenging for organizers to keep pace. In 2001, more than 3,200 students sat for the APHG exams, which were scored by 17 college professors and high school teachers (Figure 3). In 2012, more than 97,000 students sat for the APHG exam and more than 400 college faculty and high school geography teachers were needed to score these exams. By the summer of 2012, more than 430,000 high school students in the United States will have taken the APHG exam since the course was launched approximately one decade ago. APHG remains the fastest growing among the mid-to-large-sized AP courses in terms of percentage growth.

The introduction of APHG has triggered a great need for instructional materials and professional development for high school teachers who may have little or no background in the discipline. Several texts and other instruc-

Figure 3. Number of Exams Administered for AP Human Geography, by Year



Source: College Board

tional tools have been created to meet the needs of this growing APHG community. Students and parents can now purchase materials to help prepare for the APHG exam and supplement formal classroom instruction. Many Human Geography textbooks now have ancillary materials to support APHG, and one text publishes a separate APHG version for high school students. While it is unknown to what extent collaboration factored into the development of current instructional materials for APHG, it is critically important going forward that authentic collaboration between geographers and educators is part of the design and revision process. Geographers can offer their expertise on the big ideas and practices that should be emphasized in the materials, while educators can design ways to make learning those big ideas and practices accessible, comprehensible, and engaging for all students.

In response to the need for professional development, the National Council for Geographic Education (NCGE) and several state geography alliances in the National Geographic Network of Alliances for Geographic Education offer APHG professional development workshops designed and presented as a result of the collaboration of geographers, high school geography teachers, and professional development providers. One example of these collaborative professional development efforts to prepare and support APHG teachers includes the development and implementation of an online graduate-level course for novice APHG teachers, which is supported by a grant to NGCE from the National Geographic Education Foundation. The course, offered each year since 2006 by the University of Oregon Geography Department, is taught by a geography teacher with the support of geographers and NCGE.

These national-scale efforts to develop and implement an AP Human Geography course and the accompanying professional development experiences and curriculum resources provide dramatic evidence of the power of collaboration in geography education. But the need for ongoing collaboration remains. As the course grows and experienced teachers approach retirement, and as new technologies and forces of globalization change the face of human geography, geography's professional organizations, academic geographers, high school teachers, curriculum specialists, professional development providers, and the College Board need to work together to provide students access to the full potential of geography education through APHG.

* This difficult decision was made, in part, because of the recently approved AP Environmental Science class—the committee was concerned about overlapping content in both courses.

Development of Tools

Recommendation 10: Design and disseminate tools and exemplars to inspire and support educators, developers, and policy makers in leading the implementation of these recommendations.

Most education materials and tools are designed to support teachers and students in the classroom—student textbooks, teacher guides, educational games, simulations, and the like. Very few are designed specifically to support and guide professional development leaders and designers, teacher educators, instructional materials developers, researchers, and policy makers. Geography education leaders need new tools and illustrative examples for two main purposes: (1) to support them in developing a deep and shared understanding of the new vision and its implications for practice, and (2) to guide them in changing the ways they develop instructional materials and work with teachers to align with the reform vision. A set of carefully developed tools and illustrative examples to support these leaders will help the field develop and implement instructional materials and professional development programs that take these recommendations seriously.

Consider the following scenario:

> As a former geography teacher, Ms. Lee—a district curriculum supervisor—is excited about the release of the Road Map Project reports and their new vision for geography education. She hopes the recommendations in this report and the high expectations embedded in the new National Geography Standards will transform geography teaching and learning, K–12, in her district. Her superintendent agrees, and he asks Ms. Lee to plan a professional development program involving an after-school workshop on the standards for each grade level. He even agrees to give every school $500 for new maps and suggests that a map publishing company would probably conduct free workshops in exchange for the business. Suddenly Ms. Lee is not as excited as she was before. She realizes she needs to help her superintendent understand and support the full intent of the Road Map Project, but she has no idea how to do that.

Ms. Lee's superintendent does not understand that the recommendations in the Road Map Project reports are a call for reform in geography education. These recommendations call for a transformation in the kinds of geographic understanding and thinking that students should develop and for a parallel transformation in the way we educate and support teachers—both through professional development and through instructional materials. How can Ms. Lee help her superintendent understand that one-time, after-school workshops and some new maps are not going to support the kinds of changes outlined in these recommendations? What specific alternative approaches to professional development can Ms. Lee suggest to her superintendent? How can she help her superintendent understand the kinds of instructional materials that are needed to support the called-for reform? As a leader in the geography education reform effort, Ms. Lee needs support in leading the implementation of the Road Map Project vision. What tools, materials, and illustrative examples can she consult? Many teacher educators, curriculum supervisors, curriculum developers, and others who will lead the implementation of the recommendations in this report face the same quandary.

Our Committee recommends development and dissemination of tools proposed in Table 3, most of which do not currently exist, and all of which would support the vision defined in this report. In developing and disseminating these tools, the aim should be to help users—at all levels in the educational system—develop the professional knowledge, skills, and resources needed to transform geographic education.

For each tool or illustrative example to have the desired impact, it needs to be developed in a systematic and coordinated way and aligned with the development of connecting/supporting tools for all learners—students, teachers, and teacher educators. Developing a hodgepodge of interesting tools or videocases will not move us away from the current miscellany of interesting yet disconnected and uncoordinated materials, activities, and programs in geography education. To advance the field, we need materials and tools that are deeply understood and effectively implemented rather than a variety of materials

Table 3. Tools and Illustrative Examples to Support the Implementation of Committee Recommendations

For	Tool	Purpose	How to Develop
Professional Development Leaders and Teacher Educators	1. Videocases and written descriptions of the Road Map Project vision in action in K–12 classrooms.	To support teacher educators/leaders in understanding what is possible when the recommendations are implemented as intended. Videos developed are intended to illustrate high-quality teaching practice.	• Explore existing videocases and evaluate for alignment to the Road Map Project recommendations. • Conduct sustained professional development with geography teachers, using the videocases and written descriptions, to help them implement the recommendations in rich ways.
	2. Content-specific videocases for analysis of practice work in preservice and inservice professional development programs.	To develop videocases of K–12 geography teaching across grade levels and content areas that can be built into practice-based professional development programs. These videocases will support the development of content-specific knowledge for teaching through videocase analysis. Videos focus on teachers who are making good efforts to implement the recommendations (not necessarily exemplary).	• Explore existing videocases and evaluate for alignment to the Road Map Project recommendations. • Conduct sustained, content-specific professional development work with geography teachers. Create videocases of these teachers' practice.
	3. Videocases of high-quality geography teacher professional development.	To provide exemplars to support those who will be leading professional development and teacher education programs.	• Identify or conduct studies of professional development that show impact on both teacher and student learning. • Create videocases of key aspects of these programs in action for use by professional development leaders.
	4. Tools to guide and assess the quality of teacher professional development programs in geography.	To provide guidelines for those who are revising and developing new professional development programs in geography.	• Use the Guidelines in this Road Map Project report for effective professional development programs. • Study and describe existing geography-specific professional development programs: How does current practice align (or not) with the vision? • Develop and study professional development that meets the recommendations fully and is aligned with new *Geography for Life* standards. Study program effectiveness. Revise guidelines as needed.
	5. Instructional materials for professional development leaders and teacher educators (and associated materials for inservice/preservice teachers).	To support those who educate the professional development leaders and teacher educators.	• Identify professional development programs in geography that meet the recommendations and have demonstrated effectiveness with students. Such programs may not yet exist and will need to be developed and studied. • Develop curriculum guides that support the education of professional development leaders, thus creating programs for those leaders.
	6. A national digital library to house carefully reviewed, standards-based instructional materials and research-based professional development plans.	To provide high-quality resources for use in developing professional development and teacher education program experiences.	• Secure funding to establish the digital library. • Identify, create, organize, and disseminate library assets. • Develop strategies for funding the ongoing development and support of the library.

(Continued on next page)

Table 3. Tools and Illustrative Examples to Support the Implementation of Committee Recommendations (continued)

For	Tool	Purpose	How to Develop
Instructional Materials Developers	1. Guidelines for assessing geography instructional materials and professional development programs.	To support the instructional materials development, evaluation, and selection processes.	This work can be done in phases. • Phase 1 was completed by this Committee: Based on a broad literature review, develop a draft set of guidelines and indicators for high-quality instructional materials and professional development in geography. • Phase 2: Conduct a thorough review of geography instructional materials using these guidelines and indicators. Develop and test an evaluation tool for their review (rubric, scoring guide). • Phase 3: Conduct studies of instructional materials and professional development programs that were highly rated and assess whether students impacted by these programs/materials outperform students using lower-rated materials/programs. • At each phase, revise the indicators based on results.
	2. Illustrative instructional materials that exemplify the *Guidelines* for Instructional Materials and Professional Development created by this Committee.	To provide examples of the meaning of the *Guidelines* for Instructional Materials and Professional Development in geography as evidenced in instructional materials.	• Study existing geography instructional materials and identify candidate samples that match this Committee's *Guidelines* for Instructional Materials and Professional Development. • Review the nominated samples, rate them, and then meet face-to-face or virtually to develop consensus about the which are the most exemplary samples.
Policy Makers and Publishers	3. Webinars/website videos that present images of the reform vision in ways accessible to policy makers and publishers of instructional materials.	To educate policy makers and publishers about the reform vision in geography education. To help them understand both the challenge and the ultimate value of implementing these recommendations as intended.	• Conduct sustained professional development with strong geography teachers. Use this context to create videocases that illustrate what is possible at different grade bands. Video will include teacher comments about the professional development and instructional materials needed to be able to teach in these ways. • Create powerful stories using this video and student learning data. Perhaps contrast what is possible with what currently exists.
	4. White papers that highlight evidence and compelling societal issues that support the need for these recommendations.	To help policy makers and publishers understand the essence of the recommendations and both the challenge and the ultimate value of implementing these standards as intended. To provide policy makers with tools to help them make the case for geography education with their constituents and colleagues.	• Consult key reports in geography, such as *Understanding the Changing Planet* (National Research Council, 2010a), to identify societal issues that require geographically literate solutions. • Identify most compelling reasons that geography knowledge and practices are essential.
Multiple User Groups	5. Digital databases that match key concepts in geography with local geography examples that illustrate the concept.	To support professional development leaders, teacher educators, instructional materials developers, and teachers in accessing knowledge and tools to help them adapt instructional materials to local contexts while maintaining a coherent curriculum.	• Select key geography concepts. • Develop criteria for what constitutes a match between selected key concepts and local geography. • Use professional organizations and alliances to elicit nominations for local examples of the key concepts. • Submit nominations to rigorous review for match to concepts.
	6. Map of student learning progressions about central concepts and practices in geography.	To generate and use assessment tools to create maps of students' progression in coming to understand key concepts and practices across the K–12 span.	• Identify key concepts in geography, using *Geography for Life* (Heffron & Downs, 2012) standards as a guide. • Conduct research on students' knowledge and on their developing understandings of identified key concepts and practices for different age groups. • Develop assessment items and tasks that elicit students' knowledge and practice.

from which educators can piece together their individual lessons. It is emphasized throughout Recommendations 1 to 9 that the field needs coherence, connectedness, meaningful organization, and well-planned programs. This is in contrast to descriptions that characterize current practice, which often employs disparate facts, one-shot workshops, and random courses. New materials and professional development programs must be developed in a way that avoids falling into this trap.

Developers of geography education tools need to work collaboratively to help geography education leaders develop a shared understanding of what these recommendations for reforming geography teaching and learning should look like in practice. Sufficient grant funding is needed to provide the time for deliberative work that produces a few high-quality products to guide the field. The process of creating and studying these tools will help the leaders of the reform effort interpret and debate the implications of the vision for practice. They will wrestle with questions such as:

- What should these recommendations look like in practice?
- What does it mean to create a coherent set of instructional materials that engage students in developing deep understandings of geography?
- What do instructional materials that are educative for teachers as well as for students look like?
- How does it look when teachers' professional development in geography is connected and sustained over time?

This deliberative process will lead to a shared understanding of the intent of the recommendations as well as to the development of a set of tools, materials, and illustrative examples that represent the recommendations in their full intent, and that will help others develop the same understanding. This shared understanding of the reform goals is essential to enable developers and educators to implement the recommendations in this report in a way that leads to real and important change.

The right-hand column of Table 3 suggests two aspects of a systematic approach to this work. First, developing some of these tools will require a line of research that develops over time—the tools cannot be developed overnight. For example, a line of research is needed to study effective professional development programs. This line of research might start with the work done by this Committee to review research on effective professional development in other fields to develop preliminary guidelines for geography programs. The next phase of research could then use the preliminary guidelines to analyze existing programs to determine the strengths and weaknesses of geography instructional materials and professional development. Finally, the preliminary guidelines could be used to develop programs that are aligned with the Road Map Project recommendations and to study their impact on both teacher and student learning. When effective programs have been identified in this rigorous and geography-specific way, the guidelines for effective programs can be refined.

Table 3 also suggests that developing tools and examples should not be done in isolation from one another. For example, studies of professional development programs that are aligned with the Road Map Project recommendations might focus on teacher use of highly rated instructional materials. Such a study might produce videocases of geography teaching that would be useful in communicating with policy makers and publishers.

Videocases

Different types of teaching videos are available for use in teacher education. Some videos are professionally filmed, scripted, edited, and presented in documentary style with a voiceover providing a narrative to guide viewing. Other videos, called videocases, are structured to engage teachers in actively analyzing unedited classroom practice (Roth, Givvin, Chen, Lemmens, & Garnier, 2010; Sherin, & Han, 2004). The videocases can include lesson video clips, examples of student work related to the lesson video, teacher lesson plans, lesson worksheets or handouts, science content background readings relevant to the videocase, and other relevant readings (e.g., research articles). Most importantly, the videocases are framed by analysis questions that challenge teachers to dig deeply into issues of student thinking, subject matter content, coherence of the lesson, teacher decision-making, and so on.

Conclusions

An important part of Recommendation 10 is the focus on disseminating these tools and materials. As emphasized above, however, without a shared understanding of the meaning and intent of the Road Map Project recommendations, this reform effort will fail. Developing tools to support the leaders of this effort is an important step in working toward that

shared vision. Wide dissemination of the tools and ideas is essential—every effort in this line of research and development should include a strong focus from the beginning of the project on dissemination plans.

Recommended Reading

Carroll, C., & Mumme, J. (2007). *Learning to Lead Mathematics Professional Development.* Thousand Oaks, CA: Corwin Press.

Earl, L., Watson, N., & Katz, S. (2003). *Large-scale education reform: Life cycles and implications for sustainability.* Reading, U.K.: Centre for British Teachers. Retrieved from www.cfbt.com/evidenceforeducation/pdf/Lifecycles.pdf

Research That Makes Reform a Reality

The need for tools, materials, and illustrative examples to support professional developers, instructional materials developers, and policy makers is clear from reports about the failures of textbooks in other disciplines to incorporate reform-based recommendations (Kesidou & Roseman, 2002). The need is also evident in professional development, which persists in relying on the isolated workshop approach, and in teacher education programs, which address reform recommendations in scattered and superficial ways (Smagorinksy & Whiting, 1995). Similarly, studies show that teachers do not always understand the deeper intent of the reform effort and therefore implement it in superficial or contradictory ways (Earl, Watson, & Katz, 2003; Grant, Peterson, & Shojgreen-Downer, 1996; Wilson, 2002).

In mathematics and science education, the National Science Foundation has supported many projects to develop reform-based instructional materials for teachers (e.g., Biological Sciences Curriculum Study, 2011; Goldberg, Bendall, Heller, & Poole, 2003; Lappan, Fay, Fitzgerald, Friel, Phillips, 2003; McNeill, et al., 2004), but relatively few that target instructional materials *developers.* One project that did target developers was conducted by Project 2061 of the American Association for the Advancement of Science (Kesidou & Roseman, 2002). Project 2061 developed and employed detailed criteria and tools to assess the quality of math and science instructional materials (both widely used materials and those that claimed to be more reform-oriented) for the quality of attention to characteristics of reform. In a follow-up study, the project investigated whether highly rated materials were associated with higher student learning in mathematics, a question of high interest to curriculum developers, publishers, and policy makers.

Similarly, NSF has funded the development and implementation of many approaches to teacher professional development in mathematics and science, but very few of these projects support the development of professional development *leaders* or preservice *teacher educators.* This gap is being addressed in a few recent projects. In mathematics, for example, Carroll and Mumme and others have studied mathematics professional development leaders as they learned to use videocases to engage teachers in mathematics tasks (Carroll & Mumme, 2007; Elliott et al., 2009; Kazemi et al., 2010). In science, Biological Sciences Curriculum Study (BSCS) produced materials and programs to support leadership development in a statewide effort known as the National Academy for Curriculum Leadership (Taylor, Stuhlsatz, & Lamb, 2005). This project produced tools and professional development programs in the state of Washington to support the implementation of high-quality, reform-based science teaching. Targeting leaders at a variety of levels—school, district, and state—the project created a range of tools to support these different kinds of change agents. One widely used tool, known as Analyzing Instructional Materials, or AIM (Bintz, 2009), moved beyond the usual checklist of ideal features of instructional materials; instead, it engaged leaders in the process of focusing deeply on the development of science content storylines. This not only provided a tool for evaluating materials, but enhanced the leaders' understanding of the reform-based pedagogies built into the materials. A project in science education targeting teacher educators,

meanwhile, produced videocases for use with preservice teachers in elementary methods courses; it also included an instructor's guide, video of professional development leaders working with teachers, and workshops for the teacher educators (Roth et al., 2010).

Maps of student learning progressions around particular concepts and practices are another type of tool for professional development leaders, teacher educators, instructional materials developers, and especially policy makers. In science this type of work has produced two volumes of atlases illustrating a flow of idea development from first through 12th grade. These "strands" of idea development are organized around central science concepts such as motion, plate tectonics, energy flow in ecosystems, and the particulate nature of matter (AAAS, 2007, 2001). In addition, learning progressions work funded by NSF has produced learning maps about carbon-transforming processes (Mohan, Chen, & Anderson, 2009), the particulate nature of matter (Stevens, Delgado, & Krajcik, 2010), model-based reasoning (Schwartz et al., 2009), the molecular basis for heredity (Roseman, Caldwell, Gogos, & Kurth, 2006), and others.

All of these suggested tools and illustrative examples can be shared effectively through a national digital library. As with existing instructional materials and professional development resources, current digital libraries in education focus on resources for teachers rather than on resources for curriculum and professional development leaders. But strong examples of teacher-focused digital libraries can provide models for thinking about digital libraries that include tools and resources for geography education leaders. For example, researchers at the University of Colorado have developed a Digital Library for Earth System Education (Sumner, 2010). This large-scale digital effort focuses on providing high-quality resources to help teachers "customize" their teaching by providing resources that are linked to specific places in teachers' instructional materials. This model could be useful in developing a library that is designed to support instructional materials developers, professional development leaders, preservice teacher educators, and policy makers.

Recommended Research Reading

Elliot, R., Kazemi, E., Lesseig, K., Mumme, J., Carroll, C., & Kelley-Petersen, M. (2009). Conceptualizing the work of leading mathematical tasks in professional development. *Journal of Teacher Education, 60*(4), 3645–379.

Kesidou, S., & Roseman, J. E. (2002). How well do middle school science programs measure up? Findings from Project 2061's curriculum review. *Journal of Research in Science Teaching, 39*(6), 522–549.

Roth, K.J. (2010). Using video studies to transform science teaching and learning: Results from the STeLLA professional development program. In T. Janik & T. Seidel (Eds.), The power of video studies in investigating teaching and learning in the classroom (pp. 225–242). New York: Waxmann.

Geography in Practice

Videocases for Science Teaching Analysis (ViSTA)

The Videocases for Science Teaching Analysis (ViSTA) project (NSF 0957996) is produced by the Biological Sciences Curriculum Study (BSCS). The project hypothesizes that both preservice teachers and their instructors (teacher educators) will develop better understandings of effective science teaching if they have access to a rich videocase-based curriculum tool and associated analysis-of-practice professional development.

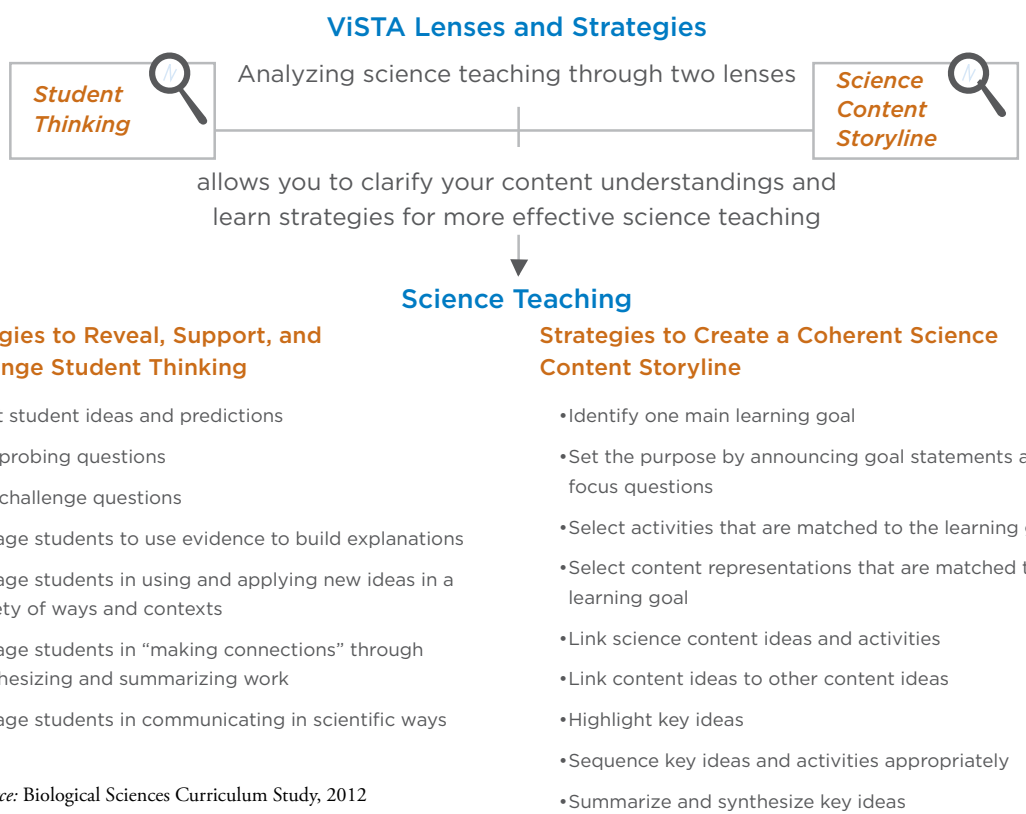
Similar to teachers in K–12 schools, preservice teacher educators typically work in isolation, developing syllabi and teaching courses on their own. The tools that support this planning and teaching usually are limited to education textbooks, research articles and policy reports, state and national standards documents, and videos of teaching from various sources. Rarely are teacher educators' selections and interpretations of these resources discussed and challenged with their peers. Their opportunities to advance their own professional growth typically are limited to attending annual professional conferences that do not provide the kind of curriculum-focused professional development experiences that are advocated as best practices for K–12 teachers. "As we 'teachers of teachers of science' well know, teachers do not get enough opportunity to work together and establish collegial bonds. We are no exception to that rule. Many of us present our work at various professional conferences, but we rarely have the opportunity to have conversations about our shared practice at traditional paper presentations" says Kate Popejoy, a teacher educator at the University of North Carolina in Charlotte.

What if high-quality professional development was more readily available for both teacher educators and K–12 preservice teachers? To explore this question, Videocases for Science Teaching Analysis (ViSTA) developed five online, videocase-based curriculum modules designed for use in teacher education programs for K–8 science teachers. The ViSTA modules are based on a research-based, conceptual framework that challenges teachers and teacher educators to analyze science teaching and learning through two lenses: the Student Thinking Lens and the Science Content Storyline Lens (see Figure 4). Each module focuses on key science ideas in one topic area (electricity, plants, force and motion, water cycle, and inquiry) and presents videocases of at least two different teachers so that preservice teachers have the opportunity to analyze different approaches to teaching the same content at different grade levels. The videocases include lesson videos, videos of student and teacher interviews, student work, teachers' lesson plans, lesson readings, handouts, and visuals. At the heart of the modules is a set of analytical tasks that challenge teachers and teacher educators to make connections between the language in research and policy reports and actual instances of classroom teaching.

The modules were studied in use in science methods classes at 30 U.S. universities, and the modules were found to deepen preservice teachers' science content knowledge and to improve their ability to analyze science teaching in terms of student thinking and the science content storyline. The preservice teachers using the ViSTA modules not only showed significant gains from pre-test to post-test, they also outperformed preservice teachers in methods courses where the ViSTA modules were not used (control group).

The study also revealed an important and unexpected impact on preservice teacher educators. To support the teacher educators in first piloting the ViSTA program and then teaching it in full as part of the research study, the project team worked with the 30 teacher educators over a two-year period. At strategic points across the two-year period, the teacher educators came to California for three different two- to three-day face-to-face meetings with each other and with the ViSTA project team. In between sessions, teacher educators communicated with each other and the project leaders electronically. Initially, the main goals for those meetings were to introduce science teacher educators to the modules, to elicit their feedback about the modules, and to learn about their experiences using them. However, from the very beginning of the project, it became clear that the meetings provided a unique and valued professional development opportunity for teacher educators. "During ViSTA workshops, I collaborated with colleagues on video analysis activities that allowed us to develop a shared language and emerging collaborative understanding of content storyline…Our collaborative understandings were developed through viewing the same video images and analyzing them together for evidence of strategies the teacher used" describes Roberta Aram, a teacher educator from Missouri State University.

Figure 4. ViSTA Conceptual Framework



Source: Biological Sciences Curriculum Study, 2012

Looking together at science teaching videos and associated student work provided a rich shared experience that challenged and deepened teacher educators' understanding of reform-based science teaching as well as their thinking about how to challenge their preservice teachers to think more deeply about science teaching and learning. The teacher educators all watched the same video clips and were pushed to provide evidence to support claims and judgments that could then be evaluated by others in the group. Through various analysis tasks, teacher educators were challenged on their content knowledge and their ability to analyze student thinking. In addition, teacher educators were challenged to anticipate preservice teachers' responses on these same tasks, to evaluate strengths and weaknesses of sample preservice teacher responses to the each task, and to consider ways they could use this task to maximize preservice teacher learning.

In the more typical conference setting, teacher educators might discuss their work, describing the kinds of activities they use in teaching their preservice teachers, but it is difficult for them to evaluate, challenge, or understand each other's claims because only one person observed or was part of the teaching. In the ViSTA context, the teacher educators all engaged their students in using the same frameworks to view the same videos and to respond to the same questions about those videos. Looking at preservice teacher writing from these tasks across 30 different institutions enabled ViSTA instructors to have much richer discussions about the evidence of preservice teacher learning from these activities than is possible in the typical conference setting. "Science teacher educators should spend time thinking about our own practice. We should move beyond our isolated thoughts and engage in conversations with other science teacher educators who are able to help us move forward in our thinking and become better at our craft," says Malcolm Butler, a teacher educator from the University of South Florida.

Recommendation 10 calls for creating tools for geography educators that are similar to the ViSTA modules. While the tools can take many forms, of which videocases are just one example, the purpose of these tools is to support both teachers and reform leaders in developing shared understandings of the kinds of changes that will improve geography teaching and learning.

For more information on ViSTA, please visit http://www.bscs.org/vista

Chapter 4: Quick Reference Tables

The guidelines and discussion questions in the following tables have been created for developers and practitioners responsible for designing, evaluating, or disseminating instructional materials and/or professional development for teachers in geography. We refer to materials and professional development as "programs," which can encompass as little as a curricular unit (i.e., three to five lessons on a topic) or as much as a multi-year collaborative project around materials and professional development. Programs described in Recommendations 1 through 4 refer to instructional material programs, while programs described in Recommendations 5 through 7 refer to professional development and teacher education programs.

Drawing directly from the recommendations, the guidelines provide advisory statements useful in supporting best practices. Each guideline is accompanied by more specific "Questions for Discussion" that can be used to prompt discussion about how well the guideline is met by the program. These guidelines and questions will prove most useful as a dialogue tool as opposed to a scoring rubric or checklist. However, the guidelines may be useful for schools and districts interested in developing their own scoring rubrics, checklists, or other evaluative tools.

The intention of this tool is to promote effective and engaging instructional materials and professional development for students and teachers. Professional development providers and curriculum developers can better understand the strengths and weaknesses of their own designs by using these guidelines and questions for discussion around program design. Likewise, practitioners can evaluate programs already in place to identify their comparative strengths and weaknesses. Each guideline is based on a solid body of research in the fields of teacher education and student learning, and each serves to enhance the learning experience for teachers and students in geography.

Recommendations 1 to 3 provide guidelines and questions on how well a program supports student learning. These guidelines and indicators are especially helpful for discussion around instructional material programs, as are guidelines and questions for Recommendation 4.

Recommendations 4 to 7 provide guidelines and questions on how well programs support teacher learning, primarily focused on professional development programs and teacher education, but also on the use of educative curriculum in Recommendation 4.

Recommendation	Guidelines	Questions for Discussion
Recommendation 1: Focus instructional materials on big ideas and practices of contemporary geography across subjects and grade levels.	**Big Ideas and Practices That Connect Learning Over Time.** Programs should focus on big ideas and practices of geography that make connections across learning experiences. *This guideline is focused on developing conceptual understanding and continuity across the curriculum while reducing the emphasis on learning of disconnected geography facts.*	How well does the program address the big ideas and practices outlined in standards for geography education?
		To what extent are big ideas and geographic practices clearly conveyed to students in the program?
		How well does the program assist teachers in developing big ideas and geographic practices across the year (or years)?
		With the instructional time allotted in the program, to what extent is thoughtful learning of big ideas and geographic practices likely to happen?
		How well is new content connected to what students have already learned, and in what ways do students reflect on these connections?
	Thinking Geographically. Programs should illustrate how geographers "think" about questions and problems, providing students with models for "thinking geographically" and creating opportunities for students to practice this type of thinking. *This guideline is focused on providing opportunities for students to observe and practice geographic thinking.*	How well does the program illustrate geographers at work and provide students with models for geographic thinking?
		To what extent does the program encourage students to compare their thinking about a question/problem to how geographers think about the same question/problem?
		In what ways does the program provide opportunities for students to practice geographic thinking?
	Strategic and Purposeful Learning Experiences. Programs should convey a sense of purpose for learning big ideas and practices, and they should include a strategic sequencing of learning experiences. *This guideline is focused on helping teachers and students see the connections between classroom activities and geography concepts and how conceptual understanding builds over time through a series of purposeful learning experiences.*	To what extent does the program articulate a purpose and rationale for learning big ideas and practices?
		How likely are the purpose and rationale guiding the program to appeal to both teachers and students?
		To what extent does the program have a strategic sequencing of activities around the big ideas and practices, and to what extent does it avoid digressive activities?
	Accurate Content That Presents Multiple Perspectives. Programs should include geo-graphically accurate content that honors diverse perspectives. *This guideline is focused on presenting accurate information to students and communicating multiple perspectives.*	Does the program present accurate geographic content and avoid stereotypes and bias?
		To what extent does the program present multiple perspectives about geographic problems and questions, or have important perspectives been ignored?

Recommendation	Guidelines	Questions for Discussion
Recommendation 2: Design instructional materials that build upon students' prior geographic knowledge and experience and challenge students' thinking.	**Identify Prior Knowledge and Experience.** Programs should include activities that connect to or draw from the rich diversity of students' prior knowledge and experiences relevant to geography. *This guideline is focused on giving attention and instructional time to sharing students' prior knowledge, so that the teacher and students begin the learning process with a clear idea of their starting point.*	How well does the program assist teachers in anticipating and probing students' prior knowledge and experience, and how well does it prepare teachers for responding to these during instruction?
		Does the program include activities to discuss students' prior knowledge and experience early in the instructional sequence, and are these activities likely to help teachers better understand what their students are bringing to the learning experience?
	Capitalize on Students' Interests. Programs should include learning opportunities that take advantage of students' natural curiosities and interests (e.g., asking questions that "hook" students). *This guideline is focused on introducing geography content that draws upon or sparks students' interest, and sustains this interest over time.*	To what extent do the questions or problems explored by the program build on students' natural curiosities and interests, and are they likely to grab student attention?
		How likely will the investigations and activities in the program sustain student interest over time?
	Challenge Student Thinking. Programs should include thoughtful questions, discussions, and other activities to challenge student thinking. *This guideline is concerned with confronting student misconceptions and validating student ideas through thoughtful activities that compare those ideas with the geography content being learned.*	To what extent does the program alert teachers to common misconceptions that students may hold?
		In what ways does the program provide experiences that call into question student misconceptions?
		To what extent does the program encourage thoughtful classroom discussion (i.e., where students are articulating and debating their ideas)?
		How well does the program encourage students to reflect on how their ideas are evolving?

Recommendations	Guidelines	Questions for Discussion
Recommendation 3: Develop instructional materials that use teaching strategies to engage all learners in meaningful explorations of geography.	**Engagement with Contemporary Geographic Questions.** Programs should engage students in asking questions about contemporary geography issues and problems. *This guideline is focused on students asking geographic questions that lead to productive inquiries.*	To what extent does the program promote students in asking geographic questions that lead to fruitful inquiries into those questions?
		How well does the program incorporate geographic questions that will likely sustain student engagement over the course of an investigation?
	Exploration of One's Local Geography. Programs should immerse students in the study of their local geography and connect geography to students' lived experiences. *This guideline supports students in better understanding geography in their local community.*	In what ways does the program tap into students' knowledge of their local geography as a resource for understanding and making connections to their own communities?
		To what extent does the program enhance student knowledge of their local communities?
	Vivid Experiences Using the Tools of Geography. Programs should use teaching methods that capitalize on geographic tools to create vivid firsthand and vicarious experiences. *This guideline is focused on utilizing geospatial tools and other visualizations to enhance learning experiences.*	How well does the program utilize tools and resources in learning activities, and are these tools central to the learning goals and not simply "bells and whistles" to attract attention?
		How well does the program use geographic tools to illustrate geography concepts and to engage students with geographic practices?
		To what extent does the program use geographic tools and resources to give students experience with geographic data?
	Variety of Learning Experiences. Programs should engage students using diverse modes of instruction and attend to the inevitable differences among students. *This guideline is focused on teaching content using a variety of methods to reach all students.*	How well does the program support students in expressing their ideas in diverse ways, and how well does it support students in interacting with content using diverse modes of engagement?
		To what extent does the program include helpful suggestions for the teacher when working with students who have different levels of understanding?
	Application of Knowledge Across Context. Programs should engage students in the application of geography content and practices to a broad range of contexts. *This guideline is focused on supporting students in using and applying new knowledge and making connections.*	How well does the program support the application of newly learned content/practices to novel situations or contexts?
		How well does the program address making connections across geographic phenomena (especially connections across scale, space, and time)?
	Developing the Language of Geography. Programs should build disciplinary language in geography, through thoughtful experiences with geographic content and practices. *This guideline is focused on students learning to understand and use geographic language to communicate.*	How well does the program support the development of disciplinary language?
		To what extent does the program provide opportunities for students to practice using geographic language in their verbal and written explanations?

Recommendation	Guidelines	Questions for Discussion
Recommendation 4: Design instructional materials to be learning tools for teachers.	**Transparent Design Process.** Programs should make explicit the theoretical underpinnings in the program, and the developers' rationale for including curricular components. *This guideline is focused on providing teachers with a better understanding of the rationale behind the design of programs so teachers clearly see the developers' intent.*	How well does the program make explicit the pedagogical assumptions that guided the development process?
		Does the program provide a rationale for how program components are related, and is it likely this rationale will help teachers better understand the designers' intent?
	Design Capacity. Programs should support teachers in making adaptations to materials to fit their individual classroom and school context, without compromising the original intent and core essence of the program. *This guideline is focused on supporting teachers in understanding the strengths and weaknesses of materials and possible ways to adapt materials to meet their classroom needs, while simultaneously using program components most effectively.*	To what extent does the program communicate priorities and what is most important to retain as teachers modify the program for their classrooms?
		To what extent does the program identify strengths of using the materials to teach particular geography content/practices?
		How well does the program identify potential shortfalls where the materials may not fit classroom and/or curricular needs, and does the program offer modifications for such cases?
		In what ways does the program help teachers make adaptations for their local classroom context, and is it clear what parts of the program should and should not be modified?
		How well does the program assist teachers in implementing program components effectively?

Note: Designing instructional materials that are effective learning tools for teachers involves additional considerations already noted in Recommendations 1 to 3, and also in Recommendation 5. In order for instructional materials to be learning tools for teachers, designers should include information about: (1) strategic sequencing of activities and about how big ideas and practices are developed across time (see Recommendation 1), (2) student thinking about the content (see Recommendation 2), and (3) content background for teachers (see Recommendation 5). Because these features are described in guidelines for other recommendations, we do not include them here.

Recommendation	Guidelines	Questions for Discussion
Recommendation 5: Develop and implement professional development programs that enrich teachers' knowledge of contemporary geography and how to teach it.	**Teacher Content Knowledge.** Programs should include geography content to prepare teachers for skillful instruction within the discipline. *This guideline is focused on teachers learning geography and doing geography to develop a deep understanding of the discipline's breadth and depth.*	How well does the program identify the big ideas and practices within contemporary geography that teachers need to know?
		How well does the program expand upon geography content for teachers, going beyond the level of understanding expected from students?
		To what extent does the program model for teachers the use of contemporary geography tools to study geographic phenomena (e.g., cartography, GIS, remote sensing, etc.)?
		In what ways does the program provide teachers with the opportunity to do geography (e.g., use tools, conduct fieldwork, analyze real data, etc.)?
	Pedagogical Content Knowledge. Programs should improve teachers' understanding of instructional strategies and methods proven most effective at engaging students in learning specific geographic big ideas and practices. *This guideline is focused on teachers learning about and choosing the most effective ways to convey particular geography ideas and practices to students.*	How well does the program capitalize on research-based instructional strategies and methods to teach specific geographic big ideas and practices?
		To what extent are the chosen strategies and methods in the program best suited for the content being taught?
		How well does the program prepare teachers to anticipate and incorporate student thinking in geography?
		In what ways does the program help teachers understand how to select teaching strategies and instructional resources to most effectively engage students in geographic ideas and practices?
		To what extent does the program help teachers understand how to observe and measure progress in student thinking, and does the program provide strategies to assess student learning in diverse ways?

Recommendation	Guidelines	Questions for Discussion
Recommendation 6: Design and implement coherent and sustained professional development programs with clear and measurable goals.	**Articulate a Vision.** Programs should be guided by a vision of effective geography teaching and learning, and they should use a model based on a theory of teacher learning with clearly articulated goals and measurable outcomes. *This guideline is focused on identifying an overall vision and set of learning goals for professional development.*	To what extent does the program communicate a vision for teacher learning, and is this vision likely to prepare teachers with high capacity for teaching geography in the 21st century?
		To what extent is the program guided by a theory or model for teacher learning that has been shown to be effective in promoting professional learning?
		To what extent does the program identify measurable outcomes for teacher learning after participation in professional development activities?
	Attend to Needs, Challenges, and Constraints. Programs should attend to the needs, challenges, and constraints of local teachers, schools, and communities, and programs should provide specific and usable approaches to bridge the gap between the vision for the professional development and reality in schools. *This guideline is focused on providing coherence between professional development and the needs of participant/ teachers involved.*	Does the program clearly identify one or more needs, challenges, or constraints of the target audience (e.g., curricular structure, resource availability, experience of teachers, etc.)?
		Does the program give attention to helping teachers and schools better understand and respond to gaps between professional development and school needs, and does the program suggest a plan for minimizing these gaps?
	Thoughtful Implementation. Programs should develop a plan that clearly considers the logistics and requirements of implementing high-quality professional development in concordance with the program's vision and goals. *This guideline focuses on important factors for implementing programs successfully.*	Has the program identified a specific teacher-audience to target, and to what extent are the activities and the mode of delivery likely to help this audience achieve the learning goals?
		Has the program allocated resources, such as an appropriate amount of contact hours and funding, to successfully accomplish the goals?
		In what ways has the program sought out collaborative partners to augment the learning experience for teachers?

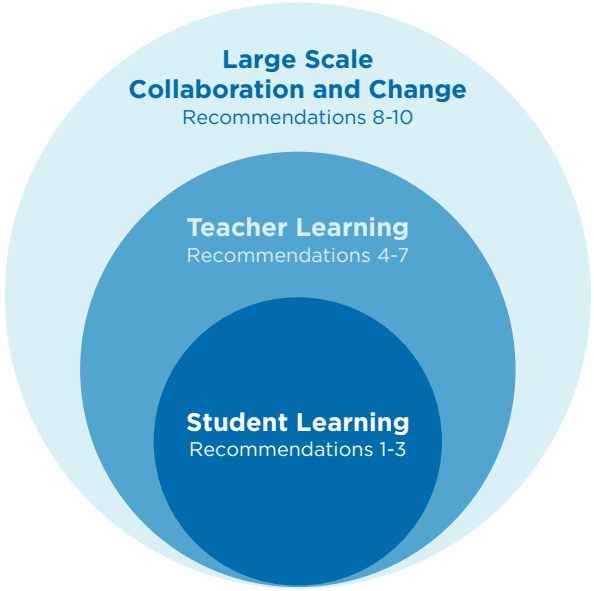
Recommendations	Guidelines	Questions for Discussion
Recommendation 7: Enhance preservice teacher education programs to emphasize teaching geography across subjects and grade levels.	**Coursework in Geography and Subject Matter Teaching.** Teacher preparation programs should provide preservice teachers with a wide and balanced understanding of geography, help them to develop geographic perspectives and skills, and prepare them to teach students to use geographic thinking and reasoning effectively. *This guideline is focused on preparing preservice teachers to understand important concepts in geography and how to teach these concepts for understanding and application.*	How do the required readings, learning activities, projects, and assessments in this course develop understandings of geography, and how it can be taught?
		How much time and what resources are devoted to student learning of the geography in this course?
		Where are the opportunities for students to develop and apply geographic knowledge and skills across their program components (e.g., a GIS training in educational technology course)? How should teachers support students in drawing upon and making connections to those opportunities in coursework?
	Field Placements. Preservice teachers should observe, inquire about, benefit from, and practice with the most effective models and examples of geography instruction during their field experiences, student teaching, and internship teaching experiences. *This guideline is focused on special consideration for the placement of preservice teachers so they have meaningful and positive experiences from which they learn how to effectively teach geography.*	How do the qualities and practices of the guide teachers, with whom I have placed preservice teachers, reflect the qualities and practices of exemplary teachers of geography?
		What field experiences will provide the best opportunities for preservice teachers to observe, plan for, instruct, and assess students learning geography?
		What is the quality of feedback for preservice teachers in their student teaching? Are their supervisors knowledgeable and experienced in effective teaching of geography?
		How are preservice teachers held accountable for their learning during field placements? How are they evaluated in relationship to content knowledge and instructional abilities for teaching geography?
	Mentoring. Preservice teachers should have knowledgeable, experienced, and motivating mentors who support and guide their early teaching experiences in geography. *This guideline emphasizes the careful selection and use of mentors who demonstrate expertise in teaching geography, serve as positive and inspiring role models, and effectively engage preservice teachers in the geographic education community early in their professional development.*	How are mentors for preservice teachers selected and what are their experiences and achievements in teaching geography?
		In what ways do mentors facilitate the learning and practice of preservice teachers in geography?
		How do we know that preservice teachers improve their preparation to become effective teachers of geography through the support of mentors?
		How do mentors prepare preservice teachers for their transition into the field of teaching geography, and how do they inspire a commitment to professional learning in the discipline?

Chapter 5: Taking Action: Summary and Next Steps

Summary

Never before in human history has it been more important for a person to be geographically literate. Our world is astoundingly complex and increasingly interdependent—economically, environmentally, politically, socially, and culturally. But the unsettling reality is that many teachers and most students are not yet geographically literate. Currently, American students are not even provided opportunities to learn enough geography to understand the very basic aspects of the world in which they live. Without explicit intervention and a dedicated focus on geographic literacy by educators, curriculum developers, and policy makers, U.S. children will be unable to thrive in the global marketplace, unlikely to connect with and care for their natural environment, and unsure about how to relate to people from other parts of the world. One thing is abundantly clear: If American children hope to participate in our democracy and play a strong leadership role in our world, they must possess geographic knowledge, skills, and perspectives. Simply put, if our children are not taught to think geographically, their success and the success of our nation and world in the 21st century are in jeopardy.

Reform in geography education cannot be achieved through small-scale research and development activities. Instead, the geography education community needs a coherent vision for geography instruction for our future, and an articulation of strategic actions to be taken by those working in the discipline, including developers, educators at all levels, and policy makers. Improving



instructional materials and professional development will be critical if reforms in geography education are to come to fruition. We situated our recommendations for improving materials and professional development into three broad categories to guide this change.

Our first category, **Recommendations to Support Student Learning,** speaks to the dire need to develop and revise instructional materials that focus on the big ideas and practices of geography. Materials need to shift from presenting geographic content information to engaging students in geographic practices that lead to the development of powerful big ideas in geography. Thus, student thinking around geographic concepts and practices should be central to instructional design, and materials should use the most effective and engaging strategies and methods to teach geography. Therefore, Recommendations 1, 2, and 3 focused on improving student learning of geography through the use of thoughtfully designed instructional materials that avoid superficial memorization of disconnected geographic facts.

Our second category, **Recommendations to Support Teacher Learning,** recognizes the need to support teacher learning across the professional development continuum, from preservice teacher preparation to ongoing professional development throughout a teacher's career. Recommendations 4, 5, 6, and 7 focused on designing instructional materials to be educative for teachers; designing, implementing, and sustaining professional development programs in ways that build teacher knowledge and support a change in practice; and providing coherent preservice teacher preparation in geography and geography teaching. Preparing and supporting teachers with a high capacity to teach geography is essential to improving student learning in geography.

Our third category, **Recommendations to Support Large-Scale Collaboration and Change,** recognizes the need for research, collaboration, and tools to support large-scale change in instructional materials and professional development in geography. In making these recommendations, this Committee drew upon research in fields beyond geography education, most notably science education. However, if we are to advance our knowledge of teaching and learning in geography, we

need to conduct more discipline-specific research. This research, along with the development of instructional materials and professional development programs, should be done through authentic collaboration across multiple invested groups. This Road Map Project report is one example of such collaboration, as members of the Instructional Materials and Professional Development Committee sought consensus across the fields of geography education, social studies education, and science education, and members drew from their backgrounds as researchers, teacher educators, teachers, administrators, and curriculum developers. Our Committee's expertise is diverse and broad-ranging, which challenged us as a group by introducing new ideas and ways of thinking about teaching and learning. We believe that this type of collaboration can lead to improvements in geography education and also can be used to develop and share tools across the community to reduce the duplication of efforts. Research, collaboration, and a focused development of tools are needed for large-scale change in instructional materials and professional development in geography.

Next Steps

This Committee synthesized research on instructional materials and professional development in order to make recommendations to improve student and teacher learning in geography. To have an impact on geography education reform, members of the community must take action. In the final section of this report, we outline essential steps that need to be undertaken by different stakeholders in the geography education community—actions that will make significant contributions to strengthen geographic literacy in the United States. While the focus of this report is on instructional materials and professional development, we recognize that these actions must be situated in the larger context of improving geography education, and therefore, we have provided a more inclusive list of action items.

Local, State, and National Policy Makers and Funding Organizations

- Provide financial and political support for school and informal education programs that prepare students for careers requiring an understanding of geography and geospatial skills, which is currently one of the highest areas of job-growth in the United States.
- Advocate for state and federal legislation that supports the teaching and learning of geography (i.e., Teaching Geography Is Fundamental Act).
- Fund research in geographic education with a focus on student achievement.
- Fund development of high-quality instructional materials and professional development programs in geography that are closely aligned to the recommendations and guidelines in this report.
- Encourage private sector and public agencies to support internships and outreach for geography teachers and students.
- Support rigorous requirements for university-based teacher preparation in geography.

Curriculum Developers

- Craft materials that incorporate effective and engaging strategies and methods, and that are designed in collaboration with teachers who use these strategies to help students develop deep understandings of geographic big ideas and practices.
- Develop materials that focus on depth of geographic understanding around big ideas and practices rather than on superficial coverage of content (i.e., geography facts).
- Design materials focused on the long-term view of learning geography—not fragmented and short-term mastery of facts, but the continuity and spiraling of ideas that align with the maturation of the student.
- Design educative materials that support effective classroom implementation, and aim to improve teacher content knowledge, teacher understanding of and use of student thinking, and pedagogical content knowledge.
- Create flexible materials that teachers can adapt easily to learners' needs in their classrooms without losing the core essence of the instructional goals.
- Incorporate examples and illustrations into instructional materials of contemporary geographic research and geographers at work.

Professional Development Providers and Developers

- Use the recommendations and guidelines in this report to support the development, implementation, and evaluation of successful professional development programs.
- Provide opportunities for long-term and sustained professional development in geography.
- Create opportunities for professional learning communities to explore, develop, and implement effective geography education programs as well as resources to support these activities.
- Integrate new or existing instructional materials and professional development programs to

provide educators with job-embedded, contextual support to meet their diverse classroom needs.

- Develop and model instructional practices that integrate geography big ideas and practices across grade levels and content areas.
- Promote the use and teaching of geospatial technologies to reflect real-world applications and learning.

Teacher Educators and University Faculty

- Develop collaborative relationships among education; geography; and science, technology, engineering, and mathematics (STEM) faculty to support geographic literacy of the college students who will lead tomorrow's classrooms.
- Promote alignment and integration of preservice education program components to present a cohesive and coordinated approach to understanding geography big ideas and practices.
- Advocate for course requirements, field placements, and assessments that provide rich opportunities for preservice teachers to develop, practice, and demonstrate understandings of effective teaching and learning of geography.
- Actively pursue field placements for preservice teachers in inspiring classrooms where learning reflects best practices in the teaching of contemporary geography.
- Introduce preservice teachers to instructional materials and geospatial technologies that support engagement, active learning, and critical thinking in the study of geography.

Teachers

- Provide dedicated instructional time each day throughout the year for sustained learning of geography.
- Avoid teaching geography as simply a litany of locations—the "where" constitutes the basic alphabet of geography, but sophisticated geographic thinking focuses on the "why there?" and the complex connections between places.
- Use active learning strategies to support student engagement with maps, geographic data, photographs, and other visualizations.
- Integrate geography with other school subjects and look for opportunities to make these linkages in your teaching to support geographic learning for every student.
- Participate in professional development that furthers expertise in teaching geography and deepens understanding of the big ideas and practices of geography.
- Select instructional materials that support depth of geographic learning over breadth of learning.
- Become an advocate for geographic literacy in your school, district, and state; use this Road Map Project report as your guide to becoming a leader in geographic education; consider joining your state geographic alliance.

District and School-Level Administrators

- Identify, hire, and support teachers with geographic expertise (or the willingness to learn via inservice professional development).
- Demonstrate to parents that geographic literacy is a priority in the school and district.
- Ensure sufficient curricular time is allocated for teaching geography.
- Dedicate sufficient time and resources for sustained professional development in geography.
- Demand that partners in teacher preparation and professional development programs understand the value of geography and align their programs to these recommendations and guidelines described in this report.
- Require adoption committees to choose instructional materials that reflect best practices represented in the recommendations and guidelines described in this report.
- Inspire others to make geographic knowledge, understandings, and skills a priority through your words, actions, creativity, and leadership.

Parents/Caregivers

Before your child enters school

- Read stories that are set in diverse places around the world.
- Use judgment-free language to discuss how places are similar to and different from your place (your community).
- Use maps to find locations and develop map reading skills.

After your child enters school

- Be an advocate for geography in your school's curriculum.
- Emphasize the importance of geography in today's world and in your child's future.
- Communicate about and model the daily

essential nature of geographic knowledge and understanding in your own life (e.g., relatives and friends living in other places, your travel for work, planning vacations and excursions, local/national/world news, etc.)

- Use maps and other visualizations to enhance discussions about places, current events, issues, school topics, travel, and so on.

Always

- Talk to your child about the world in which they live at all scales—local, regional, national, and global.
- Have maps in your house to locate where your daily resources (e.g., food, water, clothing, etc.) originate and how your decisions affect others as well as the environment.
- Have your child observe the landscape as you drive around your community and encourage your child to ask questions such as: Where are grocery stores located? Why there?
- Use puzzles, games, online maps, and other tools to support the development of your child's mental map of the world.
- Foster your child's curiosity about the world by asking questions, inviting questions, and seeking answers together.

Note: We did not create a separate action item list for geography education organizations, such as the National Council for Geographic Education or the state geography alliances, because we see these organizations filling many of the roles listed above.

Final Conclusions

Despite the challenges and great deal of work needed to improve the current status of geography education, the future looks promising. Instructional materials and professional development are a key avenue for creating exactly the kind of change we need in geography teaching and learning. We strongly believe that the use of the recommendations and guidelines provided in this report will help inform the development and implementation of transformative instructional materials and professional development in geography education. Only with such a transformation can meaningful change occur in the teaching and learning of geography.

Appendix A: Glossary

Big Ideas—the core ideas, concepts, and principles of a discipline that have broad explanatory power over diverse phenomena.

RETURN TO PAGE: 38 39 72

Book Study—a form of professional development in which teachers select, read, and discuss a common book that presents information about an issue or problem faced by those teachers; the teachers seek better understanding to address the issue or problem.

RETURN TO PAGE 84

Communities of Practice—groups of individuals bound together by what they do and by what they have learned through their mutual participation in professional development activities (adapted from Vrasidas & Glass, 2004, p. 6).

RETURN TO PAGE: 79 86

Content Knowledge—teacher knowledge of the structures of a subject matter, principles of conceptual organization, and the principles of inquiry that are used to add new knowledge to the discipline or to abandon deficient ideas (adapted from Shulman, 1987, p. 9).

RETURN TO PAGE: 67 76

Culturally Responsive Teaching/Culturally Relevant Pedagogy—using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them (quoted from Gay, 2010, p. 31).

RETURN TO PAGE 52

Curricular Knowledge—teacher knowledge that represents the full range of programs designed for the teaching of particular subjects and topics at a given grade level, the variety of instructional materials available in relation to those programs, and the set of characteristics that serve as both the indications and contraindications for the use of particular curriculum or program materials in particular circumstances (quoted from Shulman, 1986, p. 10).

RETURN TO PAGE 67

Design-Based Research—a research paradigm that studies learning in context, exhibiting the following five characteristics: (1) the design of learning environments is intertwined with the development of learning theories; (2) development and research take place through continuous cycles of design, enactment, analysis, and redesign; (3) the design work includes relevant implications and learning theories for practitioners and other educational designers; (4) the design work includes an account for how designs work in actual classroom settings; and (5) the design uses methods that link processes of enactment to outcomes (adapted from the Design-Based Research Collective, 2003, p. 5).

RETURN TO PAGE 99

Differentiated Instruction—ensuring that what a student learns, how he/she learns it, and how the student demonstrates what he/she has learned is a match for that student's readiness level, interests, and preferred mode of learning (quoted from Tomlinson, 2004, p. 188).

RETURN TO PAGE 63

Disposition—a person's prevailing tendency or inclination (adapted from Merriam-Webster dictionary).

RETURN TO PAGE: 66 85 95

Educative Curriculum—curriculum materials that seek to improve teachers' knowledge in specific instances of instructional decision making but also help teachers develop more general knowledge they can apply flexibly in new situations (quoted from Davis & Krajcik, 2005, p. 3, with minor adaptations).

RETURN TO PAGE 70

Enacted Curriculum—the realized curriculum that occurs in the changing classroom setting, which is jointly constructed by teachers, students, and the materials (i.e., the intended curriculum in use) (adapted from Ball & Cohen, 1996, p. 7; Ben-Peretz, 1990, p. 51; Remillard, 1999, p. 317).

RETURN TO PAGE 70

Evaluation—a systematic decision-making process, using quantitative and qualitative methods, to determine a program's degree of achievement toward a specific aim or objective.

RETURN TO PAGE 98

Field Placement—a learning experience that allows preservice teachers to observe, practice, and co-teach in real classroom settings.

RETURN TO PAGE 91

Fieldwork—work or study done in the field, outside of the four walls of the classroom or lab, to gain knowledge and experience through first-hand observation (see Rice & Bulman, 2001).

RETURN TO PAGE 61

Formative Assessment—assessment "undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (Black & Wiliam, 1998, p. 7).

RETURN TO PAGE 51

Geographic Lens—the ability to "acquire and use spatial and ecological perspectives to develop an informed worldview" (see Heffron & Downs, 2012, p. 13 for more discussion).

RETURN TO PAGE 38

Geographic Practices—a goal-directed set of actions that engage students in geographic inquiry: pose geographic questions, acquire geographic information, organize geographic information, analyze geographic information, answer questions and design solutions, and communicate using geographic information.

RETURN TO PAGE: 38 39 60

Geospatial Technologies—computer technologies related to mapping and interpreting physical and human features on Earth's surface (e.g., global positioning systems [GPS], geographical information systems [GIS], remote sensing [RS], and geospatial visualization) (adapted from Heffron & Downs, 2012).

RETURN TO PAGE: 62 63 99

Implementation Dip—the difficulties encountered as teachers learn new behaviors and beliefs as they implement a new curriculum, program, or teaching practice (adapted from Fullan, 2001).

RETURN TO PAGE 86

Learning Progression—descriptions of the successively more sophisticated ways of thinking about a topic that can follow one another as children learn about and investigate a topic over a broad span of time (e.g., six to eight years) (quoted from National Research Council, 2007c, p. 214).

RETURN TO PAGE: 54 99 112

Mentor—a person, such as a practicing teacher, who supports and coaches novice teachers as they enter the profession.

RETURN TO PAGE 93

Misconceptions—a wholly or partially incorrect or incomplete idea that differs from accurate disciplinary concepts.

RETURN TO PAGE 48

Pedagogical Content Knowledge—the blending of content and pedagogy into a teacher's understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction (quoted from Shulman, 1987, p. 8).

RETURN TO PAGE: 67 76 77

Pedagogical Design Capacity—a teacher's ability to employ personal resources as well as resources embedded in the materials themselves to make productive changes to curriculum materials (quoted from Davis et al., 2011, p. 797).

RETURN TO PAGE 72

Place-Based Education—an instructional approach that situates learning in and about the local community and environment, and intentionally leverages aspects of the local community to teach concepts and to build upon students' sense of place (adapted from Semken & Freeman, 2007; Sobel, 2004).

RETURN TO PAGE 61

Preservice—the period of professional learning and training for one pursuing a career in teaching; this period occurs before one is credentialed/licensed to practice in the profession.

RETURN TO PAGE 91

Problem-Based Learning—an instructional method in which students learn through facilitated problem solving (quoted from Hmelo-Silver, 2004, p. 235).

RETURN TO PAGE 60

Professional Development—the ongoing process of learning new knowledge and skills in one's profession.

RETURN TO PAGE 84

Professional Learning Communities—a collaborative group of teachers and administrators who work together continuously to engage in reflective inquiry related to teaching and learning.

RETURN TO PAGE: 85 87

Research—scholarly or scientific study or inquiry undertaken to advance a theory or knowledge on a subject.

RETURN TO PAGE 98

Spatial Thinking—one form of spatial thinking is a collection of cognitive skills and a constructive amalgam of three elements: concepts of space, tools of representation, and processes of reasoning; it is the concept of space that makes spatial thinking a distinctive form of thinking (adapted from National Research Council 2007a, p. 12).

RETURN TO PAGE: 53 63

Summative Assessment—assessment used to benchmark student learning to determine if students have achieved a desired level.

RETURN TO PAGE 51

Technological Pedagogical Content Knowledge—integrative model of teacher knowledge that unites content, pedagogy, and technology into a comprehensive framework (Mishra & Koehler, 2006).

RETURN TO PAGE 77

Appendix B: Committee Biographies

Emily M. Schell

Committee Chair

Lecturer, San Diego State University and Alliance Liaison, National Geographic Education Foundation

Emily M. Schell serves on the Teacher Education faculty at San Diego State University, where she teaches Social Studies Methods and leads the Linked Learning cohort for secondary preservice teachers working in urban schools that provide rigorous interdisciplinary studies, college and career preparation, and use project-based learning in collaboration with industry partners. Formerly a K–12 teacher, principal, district social studies resource teacher, and County History-Social Science coordinator in San Diego, she has worked extensively in professional development and curriculum development with the California Geographic Alliance, California's Education and the Environment Initiative (EEI), San Diego County Office of Education, San Diego Unified, Salinas Union High School District, Teaching American History programs, Colonial Williamsburg Teacher Institute, California Council for the Social Studies, and Macmillan/McGraw-Hill. Emily is currently liaison to nine geographic alliances in the National Geographic Education Alliance Network dedicated to building geographic literacy in the United States, Canada, and Puerto Rico. She earned a BA in Diversified Liberal Arts from the University of San Diego, MS in Journalism from Northwestern University, and EdD in Education Leadership from the University of San Diego.

Kathleen J. Roth

Committee Co-Chair

Senior Science Educator, Biological Sciences Curriculum Study (BSCS)

Kathleen J. Roth is senior science educator at the Biological Sciences Curriculum Study (BSCS), a nonprofit science education organization in Colorado. Kathy's current research and development work focuses on videocase-based lesson analysis programs to support preservice and inservice teacher learning. Her research examines impact on student learning as well as on teacher learning and, thus, makes an important contribution to the field's understanding of science teacher professional development that makes a difference in terms of student learning. This line of research began with her work as a teacher-researcher in elementary science classrooms and continued with her role as director of the *TIMSS Video Study of Eighth-Grade Science Teaching,* the *Science Teachers Learning from Lesson Analysis* (STeLLA) project, and the *Videocases for Science Teaching Analysis* project (ViSTA). She earned a BA in Biology from Duke University, a master's degree in Secondary Science Education from Johns Hopkins University, and a PhD in Science Education from Michigan State University. Her career in education includes seven years as a middle and high school science teacher followed by 15 years as a teacher educator and researcher at Michigan State University, and 10 years as a researcher at and then director of LessonLab Research Institute (Santa Monica, CA). She has been at BSCS since 2009.

Audrey Mohan

Committee Research Director

National Council for Geographic Education

Audrey Mohan is currently the research director for the Instructional Materials and Professional Development Committee. Formerly she worked as an assistant professor of social studies education at the University of Texas–San Antonio and as a high school social studies and special education teacher. Audrey's research interests include teacher education in geography and development of pedagogical content knowledge. She is interested in informal education experiences in geography, and received a Fulbright-Hays Group Project Abroad to Ecuador to study how travel influences teachers' content knowledge and cultural worldview. Audrey also has worked on educational policy initiatives as the Grosvenor Scholar for National Geographic Society, and she has written and reviewed geography and social studies curriculum for the states of Texas and California. She serves on the Research Committee for the National Council for Geographic Education. Audrey has a BA in History from the University of Notre Dame, an MEd from University of Texas-Austin, and a PhD in Geography, with an emphasis in Geography Education, from Texas State University-San Marcos.

Lindsey Mohan

Lead Writer on Instructional Materials

Educational Consultant

Lindsey Mohan is an education consultant in science and geography education. Her work focuses on the design of innovative instructional resources and effective teaching practice. Lindsey has recently worked on the development of learning progressions in science. She was a lead developer for the carbon cycle learning progression when she worked as a post-doctoral researcher and research scientist on the Environmental Literacy Project at Michigan State University. Lindsey also directed the development of the *Environmental Literacy Teacher Guide Series* in her role as climate education manager at National Geographic Society. Lindsey completed a BA in Psychology from the University of Notre Dame, and a PhD in Educational Psychology and Educational Technology from Michigan State University.

Keith C. Barton

Committee Member

Professor of Curriculum and Instruction and Adjunct Professor of History, Indiana University

A former elementary and middle school teacher, Keith C. Barton is currently coordinator of secondary and graduate social studies programs at Indiana University. For the past 20 years he has taught methods courses for elementary, middle, and secondary social studies teachers, as well as a variety of history, methods, and research courses for masters and doctoral students. His research investigates students' historical understanding, classroom contexts of teaching and learning, and the history of the social studies curriculum. He has served as a visiting professor in Singapore, New Zealand, and Northern Ireland, and he is the author, with Linda S. Levstik, of *Doing History: Investigating with Children in Elementary and Middle Schools* (Routledge, 2011); *Teaching History for the Common Good* (Routledge, 2004); and *Researching History Education: Theory, Method, and Context* (Routledge, 2004); as well as editor of *Research Methods in Social Studies Education: Contemporary Issues and Perspectives* (Information Age Publishing, 2006).

Mark H. Bockenhauer

Committee Member

Professor of Geography, St. Norbert College

Mark H. Bockenhauer is professor of geography at St. Norbert College in De Pere, Wisconsin. He is a former geographer-in-residence at the National Geographic Society and past assistant director of the Society's Geography Education Program. He teaches courses in World Regional Geography, Social Geography, Environmental Studies, and Global Urbanization. Mark has extensive experience in teacher professional development and in the creation of geography classroom materials. He wrote the best-selling book *Our Fifty States,* and co-wrote the *World Atlas for Young Explorers,* 3rd edition—both for National Geographic. He is coordinator of the Wisconsin Geographic Alliance, and served as president of the National Council for Geographic Education in 2007. He earned a bachelor's degree in Geography at the University of Wisconsin-La Crosse, a master's degree in Applied Geography from Southwest Texas State University (now Texas State University-San Marcos), and a doctorate in Geography from the University of Wisconsin-Milwaukee. Mark and his family live in De Pere, Wisconsin.

Bert Bower

Committee Member

CEO, Teachers' Curriculum Institute

Bert Bower has truly experienced the classroom from every perspective. He began his career as a classroom aide, then taught social studies for eight years, and finally earned a PhD in Curriculum and Teacher Education from Stanford University. For the past 20 years he has been crafting innovative K–12 social studies programs by collaborating with teachers and trying out new ideas in the classroom. His goal is to defeat the "silent violence" of stand-and-deliver teaching that leaves youth passive and bored. He aims to this by creating programs that teach students to ponder and participate. Bert combines proven teaching strategies with cutting-edge technology to successfully reach all learners in the diverse classroom, even the students who sit in the back of the classroom and rarely speak. He knows his goals are lofty, but he has witnessed the success of TCI programs around the country.

Paul T. Gray, Jr.

Committee Member

Teacher, Russellville High School, Russellville, Arkansas

Paul T. Gray, Jr. teaches Advanced Placement® (AP) Human Geography, International Relations, and World Religions at Russellville High School in Arkansas, where he is chair of the social sciences and humanities department. He is a National Board Certified Teacher and has been active in the development of AP Human Geography since its inception in 2000. He has presented at numerous geographic conferences throughout the United States, Europe and Australia, and he is a former member of the AP Human Geography test development committee. In 2008, he was named Arkansas Teacher of the Year by the Arkansas Department of Education. Also in 2008, Paul was selected as a Grosvenor Teacher Fellow by the National Geographic Society. He received the Distinguished Teaching Award from the National Council for Geographic Education (NCGE) in 2003, and he is on the board of the Arkansas Geographic Alliance. Paul is vice president for Curriculum and Instruction for NCGE, and he is on the editorial board of the *Journal of Geography.* He holds a BA and MEd in Social Sciences Education from Arkansas Tech University.

Susan W. Hardwick

Committee Member

Professor Emerita, University of Oregon

Susan W. Hardwick serves on the geography faculty at the University of Oregon. She is past president of the National Council for Geographic Education and a former Councilor for the Association of American Geographers and the American Geographical Society. She specializes in geographic education, urban geography, and the geography of immigration. Susan has authored 11 books and a long list of refereed journal articles and book chapters, including three widely used textbooks—*My World Geography* (middle school level); *The Geography of North America: Environment, Political Economy, and Culture;* and *Geography for Educators: Standards, Themes, and Concepts* for preservice and inservice teachers. She was the co-host of *The Power of Place* (an Annenberg public television series) and, most recently, was awarded the NCGE's Distinguished Mentor Award and the AAG's *Gilbert Grosvenor Award in Geographic Education.* Before joining the faculty at Oregon, she was selected out of more than 23,000 California faculty for the California Statewide Outstanding Professor Award.

Verneda E. Johnson

Committee Member

Science Coach, Isaac Newton Middle School for Math and Science, New York, NY

Verneda E. Johnson serves as the science coach at Isaac Newton Middle School for Math and Science and currently teaches eighth grade. She holds a firm belief that quality science instruction in urban schools is essential for preparing students to meet the challenges of the new millennium. Her research has centered on themes of social justice; specifically the intersection between science, school, and life in the urban setting. Verneda has worked extensively on curricular reforms, community-based partnership development and professional development that support teachers and schools in bringing inquiry-based science to underserved students, such as Urban Advantage with AMNH and Developing Futures with General Electric. She has earned a BS in Nutrition from Howard University, a MS in Elementary Education from Lehman College, and an EdD from Teachers College.

Lydia J. Lewis

Committee Member

Teacher, National Cathedral School, Washington, DC

Lydia J. Lewis began her education career as an elementary school teacher in Norman, Oklahoma. She then joined the Geography Education Division at National Geographic Society as a state liaison for the Geographic Alliances and as manager of the Instructional Leadership Institutes. After several years, she moved to a new division and was an editor for School Publishing. Later she left National Geographic to return to the classroom. She currently teaches fifth grade U.S. History/Geography at the National Cathedral School. Over the years, Lydia has been an active member of the National Council for Geographic Education and serves as associate editor for *The Geography Teacher.* She was on the original writing committee for the National Geography Standards and

recently was a part of the Geography Standards update committee. Ms. Lewis received a BA in Elementary Education from University of Arkansas at Little Rock and a master's degree in Education from the University of Oklahoma.

Dagoberto Eli Ramirez

Committee Member

Educational Leadership Doctoral Candidate, University of Texas-Pan American

Dagoberto Eli Ramirez is currently a doctoral candidate in Educational Leadership at the University of Texas-Pan American in Edinburg, Texas. Formerly a middle school English language arts, history, and geography teacher and district social studies coordinator at La Joya ISD in La Joya, Texas, and a Region One Education Service Center social studies education specialist in Edinburg, Texas, he has worked extensively in professional staff development in curriculum, instruction, and assessment with the Texas Alliance for Geographic Education, the Region One Education Service Center, the Texas Education Agency, the Texas Higher Education Board, and the La Joya ISD. He also has worked on numerous projects and committees with the National Geographic Society, the National Assessment of Educational Progress, and the National Council for Geographic Education, and he wrote and directed three Teaching American History Grants (totaling $3.65 million) at La Joya ISD. He earned a BA in English Language Arts and an MS in Education Administration from the University of Texas-Pan American.

Gwenda Rice

Committee Member

Professor Emerita, Education, Western Oregon University

Gwenda Rice is professor emerita at Western Oregon University where she taught Social Studies Methods, worked with school districts, and taught in the geography department. She is the co-coordinator of the Oregon Geographic Alliance (OGA) which provides professional development for teachers through summer institutes, annual conferences, and international travel. She taught high school geography in Britain, Nigeria, and Australia, and she taught at the college level after obtaining her master's degree in Geography at the University of Northern Colorado and PhD at the University of North Carolina-Chapel Hill. She served on the Oregon Social Science Standards Committees, the Oregon Council for Social Studies Board, and recently co-authored *Student Atlases of Oregon* for elementary and middle level, in English and in Spanish. She serves on the College Board Social Science Advisory Committee and she has served as vice president for Curriculum and Instruction and president for the National Council for Geographic Education.

Ann Rivet

Committee Member

Associate Professor of Science Education, Teachers College, Columbia University

Ann Rivet is an associate professor of science education at Teachers College, Columbia University. Her research examines the role of teachers and innovative curriculum in inquiry-based learning environments, and how students develop rich understandings of science content in urban middle school settings. Ann also serves as the Earth Science content-area specialist in the science education program, with specific expertise in students' interpretation and use of models and other representations for developing understandings of the Earth. Her work has been published in several leading journals, including the *Journal of Research in Science Teaching,* and she has presented her work at multiple national and international settings, including the American Educational Research Association and the International Conference of the Learning Sciences. She has a bachelor degree in Physics from Brown University, and a PhD in Science Education from the University of Michigan.

Andrew W. Shouse

Committee Member

Assistant Research Professor, Learning Sciences, and Associate Director, Institute for Science + Math Education, University of Washington

Andrew W. Shouse focuses on equitable science education in formal and informal settings, teacher collaboration, and communication of research to policy and practice audiences. Shouse's work is informed by a breadth of experiences in practice, including teaching elementary and middle grades, science center administration, and policy analysis. Prior to his appointment at University of Washington, Andy was senior program officer at the National Research Council's Board on Science Education (2003–2008), where he directed two consensus studies and edited the reports *Learning Science in Informal Environments: People, Places, and Pursuits* (NRC, 2007; with Bell, Lewenstein, and Feder) and *Taking Science to School: Learning and Teaching Science in Grades K–8* (NRC, 2007; with Duschl and Schweingruber), and he authored (with Michaels and Schweingruber) *Ready, Set, Science! Putting Research to Work in K–8 Science Classrooms.* He completed a PhD in Curriculum, Teaching, and Educational Policy at Michigan State University.

Janet S. Smith

Committee Member

Professor, Shippensburg University of Pennsylvania

Janet S. Smith's engagement with geography education has spanned several decades and locations. Currently a professor of geography at Shippensburg University of Pennsylvania, Jan's career began as a high school social studies teacher in Virginia. Her involvement with the Virginia Geographic Alliance inspired her to focus on issues related to learning geography, spatial thinking, and cartographic cognition in graduate school. Jan has served as the vice president for Curriculum and Instruction and as the president of the National Council for Geographic Education, and she is actively involved in the Association of American Geographers, American Geographical Society, and the National Council for the Social Studies. Additionally, she has contributed to the *21st Century Skills Map: Geography;* she serves on the editorial board for the *Journal of Geography;* and she is a North American regional editor for the *Journal of Geography in Higher Education.* Currently, Jan is the coordinator for the Pennsylvania Alliance for Geographic Education working to develop geographic literacy across the state through outreach to teachers, schools, and informal educators. Jan was recently recognized as the Pennsylvania Distinguished Geographer for her contributions to geography education across the United States and in Pennsylvania. She holds a BA from the University of Virginia, and an MA and PhD from the University of Georgia.

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