Chapter One

Inquiry

A Continuum of Ideas, Issues, and Practices

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> *Inquiry is not a "method" of doing science, history, or any other subject in which the obligatory first stage in a fixed, linear sequence is that of students each formulating questions to investigate. Rather, it is an approach to the chosen themes and topics in which the posing of real questions is positively encouraged whenever they occur and by whoever they are asked. Equally important as the hallmark of an inquiry approach is that all tentative answers are taken seriously and are investigated as rigorously as the circumstances permit.*
>
> —Wells (1999)

Differences and Similarities

Distinctions among academic disciplines arise from their principal elements of interest. Unique approaches and tools help answer the special brand of questions that puzzle its disciples. Geographers investigate spatially referenced objects with modern technologies such as global positioning systems. Scientists study phenomena with equipment that extends the senses. Historians seek to understand events using evidentiary documents, historic narratives, and forensic instruments. Symbolic representations and high-speed computers are integral features for understanding the mathematical domain. For students of language, answers are found through private and public interpretations of text. People are the stuff of universal and eternal curiosity. Inquiry—the practice of extracting meaning from experience—is the habit that binds. It drives the pursuit of understanding across all areas of study. Every chapter in Part I explores this dichotomy between the common practice of inquiry among the disciplines and the special approaches and tools that support inquiry within each content area.

Ideas

References to seminal educational thinkers such as John Dewey, Lev Vygotsky, Jean Piaget, and Jerome Bruner appear throughout this book. These foundational figures offered their perspectives on inquiry and explained why problem solving provides an all-important context for actively engaging students in meaningful learning. Their combined work created an impetus for grounding classrooms in inquiry across all areas of the curriculum.

The legion of ideas, beliefs, definitions, and descriptions of inquiry all boil down to one: *Inquiry is any activity aimed at extracting meaning from experience.* Whether it is a fire marshal sifting though a pile of smoldering ashes, a team of geologists analyzing Mount St. Helen's seismic data, or students asking probing questions about the lingering impact of the Civil War based on their reading of *Confederates in the Attic* (Horwitz, 1998), all of these preoccupations share the characteristic of being a search for understanding.

Although most commonly associated with science, inquiry includes an overarching set of principles, process skills, and a comprehensive information base that is relevant for thinking about effective classroom practice in all fields of study. As Dow (1999) stated, "Inquiry has its roots in the inherent restlessness of the human mind" (p. 5). All bodies of knowledge emerge from collective attempts to answer a discipline's core questions.

DeBoer (1991) presented an excellent overview of how inquiry teaching evolved. He noted that over time,

> inquiry teaching came to be associated with a set of instructional practices that [is] . . . inductive in nature. Inductive approaches are based on the premise that students can be inquirers in classrooms and generate meaning more or less independently by examining a variety of available learning materials. (p. 208)

Inquiry is often falsely equated with having students perform hands-on activities. Students who are engaged in mathematical inquiry might be doing *gedanken,* or thought experiments. History students could be analyzing online primary source documents. Conversely, a set of highly engaging activities about Egypt could have the look and feel of inquiry. But as pointed out by Marlowe and Page in Chapter 9, unless these learning experiences foster significant understanding of geography concepts, they constitute "sham" inquiry. What distinguishes inquiry from other classroom events is the attempt to draw meaning out of experience. Without driving, answerable questions and an emphasis on sense making, no classroom experience has a true connection with the process of inquiry.

Inquiry is not an all-or-nothing proposition. Like most practices and habits of mind, it manifests itself along a continuum that shifts according to time, place, and circumstance. As the inquiry model presented in the science chapter illustrates, the principal factor that determines the level of inquiry is the relative amounts of student versus teacher control over an activity. The skills, processes, tools, and elements of inquiry are developmental. Skillful teachers know that choosing the most appropriate instructional strategy is influenced by the time of year, age level, amount of experience, and nature of the learning activity. Gradual release of control over classroom events is how most teachers phase inquiry into their programs.

Issues

Chapter 7, which addresses curriculum integration, points out that elementary school teachers have the monumental task of helping students achieve standards-setting performances across the entire range of disciplines. Despite the fact that there are so many standards and so little time, teachers must fulfill this responsibility as a condition of their continued employment. Integrated approaches to delivering curriculum may be the only viable means of addressing the multitude of standards that students must meet during their K–12 education.

A crosswalk is a systematic procedure for generating and representing cross-comparison data. In the matrix given in Figure 1.1, the science-as-inquiry standards serve as anchor points for comparing how standards from different content areas treat the topic of inquiry. Science was chosen as the basis for comparison because the National Science Education Standards (National Research Council, 1996) make such a strong commitment to inquiry. The science standards divide inquiry into Abilities to Do Inquiry and Understandings About Inquiry, and treat it as a distinct content standard area.

In preparing the crosswalk, national standards from all major disciplines were reviewed and technology standards were added. The information in Figure 1.1 is my own interpretation of how different standards address the topic of inquiry.

As these data indicate, elements of inquiry cut across all of the national standards. This offers compelling evidence that teaching and learning through inquiry is a natural and coherent way to simultaneously approach standards from a multitude of disciplines, and to do so with strong intention. Such an approach is one way to address Fogarty's (2002) claim that "the only way the compendium of standards can possibly be met is by clustering standards into logical bundles and addressing them in an explicit and integrated fashion" (p. 1).

Practices

Delisle (1992) maintained that "all education involves either problem solving or preparation for problem solving" (p. 1). Teachers from across the full K–16 spectrum are increasingly using open-ended, in-depth explorations to create rich educational contexts in which the artificial barriers between disciplines are reduced or eliminated. Any novice-to-expert shift is apt to be stressful. Teachers who are moving toward inquiry commonly experience an initial sense of unease during the period when questions remain unanswered and children are adapting to the unfamiliar roles of question posers and problem solvers.

Creating conditions that reinforce inquiry must be systemic and sustained. Inquiry-based teaching and learning pay special attention to motivational factors, provide opportunities for social interaction, and create active learning environments. In such settings, traditional classroom roles for students and teachers are blurred, and formats for assessment are multiple, varied, and carefully aligned with the relevant content standards.

Figure 1.1 Standards Crosswalk

SCIENCE	GEOGRAPHY	ENGLISH/ LANG. ARTS	HISTORY	MATHEMATICS	TECHNOLOGY
ABILITY: Ask a question about objects, organisms, and the events in the environment.		7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems . . .	**3. Historical Analysis and Interpretation** A. Formulate questions to focus their inquiry or analysis. **2. Historical Comprehension** C. Identify the central question(s) the historical narrative addresses. **4. Historical Research Capabilities** A. Formulate historical questions.	**1. Problem Solving** B. Solve problems that arise in mathematics and in other contexts.	
ABILITY: Plan and conduct a simple investigation.		3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts . . .	**4. Historical Research Capabilities** D. Marshal needed knowledge of the time and place, and construct a story, explanation, or historical narrative.	**1. Problem Solving** C. Apply and adapt a variety of appropriate strategies to solve problems. D. Monitor and reflect on the process of mathematical problem solving.	
ABILITY: Employ simple equipment and tools to gather data and extend the senses.	How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information.	8. Students use a variety of technological and information resources . . .	**1. Chronological Thinking** D. Measure and calculate calendar time.		7. Routinely and efficiently use online information resources to meet needs for collaboration, research, publications, communications, and productivity.

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Figure 1.1 (Continued)

SCIENCE	GEOGRAPHY	ENGLISH/ LANG. ARTS	HISTORY	MATHEMATICS	TECHNOLOGY
ABILITY: Use data to construct a reasonable explanation.	How to use mental maps to organize information about people, places, and environments.	7. . . . they gather, evaluate, and synthesize data from a variety of sources.	**1. Chronological Thinking** E. Interpret data presented in time lines. G. Explain change and continuity over time. **2. Historical Comprehension** F. Draw upon data in historical maps. G. Draw upon visual and mathematical data presented in graphs. H. Draw upon the visual data presented in photographs, paintings, cartoons, and architectural drawings. **4. Historical Research Capabilities** B. Obtain historical data. C. Interrogate historical data.	**5. Representation** A. Create and use representations to organize, record, and communicate mathematical ideas. B. Select, apply, and translate among mathematical representations to solve problems. C. Use representations to model and interpret physical, social, and mathematical phenomena.	
UNDERSTANDING: Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.	How to analyze the spatial organization of people, places, and environments on Earth's surface.	3. . . . Students draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features.			

SCIENCE	GEOGRAPHY	ENGLISH/ LANG. ARTS	HISTORY	MATHEMATICS	TECHNOLOGY
UNDERSTANDING: Scientists use different kinds of investigations depending on the questions they are trying to answer. Types of investigations include describing objects, events, and organisms; classifying them; and doing a fair test.			**5. Historical Issues-Analysis and Decision-Making** A. Identify problems and dilemmas in the past. B. Analyze the interests and values of the various people involved. C. Identify causes of the problem or dilemma. D. Propose alternative choices for addressing the problem. E. Formulate a position or course of action on an issue. F. Identify the solution chosen. G. Evaluate the consequences of a decision.	**1. Problem Solving** A. Build new mathematical knowledge through problem solving.	
UNDERSTANDING: Simple instruments, such as magnifiers, thermometers, and rulers, provide more information than scientists obtain using only their senses.					8. Select and apply technology tools for research, information analysis, problem solving, and decision making in content learning.

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Figure 1.1 (Continued)

SCIENCE	GEOGRAPHY	ENGLISH/ LANG. ARTS	HISTORY	MATHEMATICS	TECHNOLOGY
UNDERSTANDING: Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations.		8. . . . Students gather and synthesize information and create and communicate knowledge.	**3. Historical Analysis and Interpretation** B. Compare and contrast differing sets of ideas, values, personalities, behaviors, and institutions. C. Analyze historical fiction. D. Distinguish between fact and fiction. E. Compare different stories about a historical figure, era, or event. F. Analyze illustrations in historical stories. G. Consider multiple perspectives. H. Explain causes in analyzing historical actions. I. Challenge arguments of historical inevitability. J. Hypothesize influences of the past.	**2. Reasoning and Proof** A. Recognize reasoning and proof as fundamental aspects of mathematics. B. Make and investigate mathematical conjectures. C. Develop and evaluate mathematical arguments and proofs. D. Select and use various types of reasoning and methods of proof.	

SCIENCE	GEOGRAPHY	ENGLISH/ LANG. ARTS	HISTORY	MATHEMATICS	TECHNOLOGY
UNDERSTANDING: Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations.		7. . . . communicate their discoveries in ways that suit their purpose and audience.		10. Collaborate with peers, experts, and others to contribute to a content-related knowledge base by using technology to compile, synthesize, produce, and disseminate information, models, and other creative works.	5. Use technology tools and resources for managing and communicating personal/ professional information.
UNDERSTANDING: Scientists review and ask questions about the results of other scientists' work.				**4. Connections** A. Recognize and use connections among mathematical ideas. B. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. C. Recognize and apply mathematics in contexts outside of mathematics.	

Some people do not routinely wonder about the unknown. Strong inquiry teachers do. They possess an inquiry stance (Cochran-Smith & Lytle, 1999). This refers to a general way of thinking about teaching characterized by a preference for asking instead of answering questions and an eagerness to move away from center stage. Learning to tolerate ambiguity in the classroom can be difficult for everyone. Children need constant support and reassurance that they are fully equipped to meet the challenge of taking charge of their own learning. The essential features of an inquiry-based classroom are engagement in activities that are congruent with the developmental readiness of students, frequent opportunities to ask and answer questions, a gradual but steady movement toward student control over the learning environment, and a growing record of successful accomplishments. Watching children as they solve problems or clarify issues is like observing a muddy suspension change over time. What first appears as cloudy or even opaque gradually clears as understanding emerges.

As an instructional framework, classroom inquiry is often depicted as a set of recurring learning events commonly referred to as the inquiry cycle. Although they differ in detail, most models include stages during which students

- Ask an answerable question or identify a researchable problem
- Develop a plan and take some form of action
- Gather resources; analyze and summarize information
- Draw conclusions and report findings
- Reflect on the process

Because learning through this type of format is highly responsive to the context, the process is dynamic rather than linear, rigid, and prescriptive. And a particular inquiry experience may include only portions of the complete cycle.

The following chapters demonstrate that using inquiry approaches to teach and help children learn is fully consistent with student-centered, activity-based, and constructivist models of instruction. Enduring dispositions are the principal goal of inquiry-based learning experiences because these "habits of mind and tendencies" are what students need "to respond to categories of experiences across classes of situations" (Katz & Chard, 1994, p. 30). Adept problem-solving adults have the cognitive flexibility needed to successfully apply what is learned in one context to a myriad of novel circumstances.

References

Cochran-Smith, M., & Lytle, S. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education, 24*(8), 249–305.

DeBoer, G. E. (1991). *A history of ideas in science education: Implications for practice.* New York: Teachers College Press.

Delisle, R. (1992). *How to use problem-based learning in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.

Dow, P. (1999). Why inquiry? A historical and philosophical commentary. In *Foundations*, *Volume II, A monograph for professionals in science, mathematics, and technology education: Inquiry, thoughts, views, and strategies for the K–5 classroom* (pp. 5–8). Arlington, VA: National Science Foundation.

Fogarty, R. (2002). *How to integrate the curricula*. Arlington Heights, IL: SkyLight Professional Development.

Horwitz, T. (1998). *Confederates in the attic*. New York: Random House.

Katz, L. C., & Chard, S. C. (1994). *Engaging children's minds: The project approach*. Norwood, NJ: Ablex.

National Research Council. (1996). *National science education standards.* Washington, DC: National Academy Press.

Wells, G. (1999). *Dialogic inquiry in education: Building on the legacy of Vygotsky.* Cambridge, UK: Cambridge University Press.