Reading: Ch. 1. Inquiry-Based Learning *(Curriculum Connections Through the Library)*

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Inquiry-Based Learning

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Twenty-four ninth graders buzz with excitement at the start of their new social studies unit, "Through Youthful Eyes." Each group of students has received a different historical photograph: a lone youth squaring off against the tanks at Tiananmen Square; young black children being blasted by fire hoses in 1960s Alabama; a young Vietnamese girl running from the flames of her village; adolescent males hanging out on an inner-city street corner in Los Angeles; starving babies staring from makeshift cribs at a temporary hospital in Rwanda. The teacher, Mr. Burwich, carefully facilitates this learning experience with primary sources. "Observe your photo carefully. What do you see? What do you assume?" Through a series of experiences over the next few days, Mr. Burwich leads his students to answer other questions about their photographs: What do you already know about the context? What do you predict led up to this moment? What do you predict followed this moment? How were your assumptions and predictions affected by the youthfulness of the subject in the photo? The students are hooked. Each picks a major historical situation and conducts his or her own inquiry, guided by the essential question: How does the lens of "youthful eyes" affect our interpretation of history?

Inquiry is not just for science class anymore. In schools across the country, educators are responding to the increased emphasis on high standards and to a strengthening body of research about learning and the brain by developing an in-depth, inquiry-based approach to curriculum, teaching, and learning. Inquiry learning follows a fairly standard process that involves starting with what the

learner knows, asking intriguing questions about what is not known, investigating the answers, constructing new understandings, and communicating to share those understandings with others.

But inquiry is much more than simply following a process. It is an essence of teaching and learning that places students at the heart of learning by empowering them to follow their sense of wonder into new discoveries and insights about the way the world works. The Center for Inquiry at the University of South Carolina describes the power of inquiry as an overarching educational philosophy:

> It is a way of living and learning together; a way of viewing and learning about the amazing world in which we live; a way of honoring and learning from the diversity that is humanity; a way of being true to ourselves, our children, and the profession; a way of fostering genuine professional development; and, most importantly, a way of respecting, building upon, and supporting all learners, tall and small. (Mills and Donnelly 2001, xix)

Any investigation of inquiry as a model for curriculum development, instructional design, teaching strategies, and learning behaviors naturally generates questions about the nature and practice of inquiry. The answers to those questions may provide a frame for classroom teachers and library media specialists to create communities of inquiry in their own schools.

HOW IS INQUIRY DIFFERENT FROM INFORMATION PROBLEM SOLVING?

Educators have long recognized the value of assigning research projects to give students the opportunity to learn on their own. In the best situations, classroom teachers and librarians collaborated to design the instruction and teach research skills and strategies while the students were pursuing their topics. The purpose of the assignment generally was for the students to find the best information about a problem or issue in order to support a thesis and to reorganize that information into a final product. The process was controlled and rather linear—the students knew where they would end up before they started. Because the research process was so prescribed, students learned to fill in the blanks as a mental exercise with little real engagement. Consequently, classroom teachers and librarians constantly battled plagiarism and the "report" syndrome, and students puzzled over what teachers wanted if not a report.

In contrast, inquiry-based learning is more open-ended. Research on how people learn has provided educators with new impetus to engage students in constructing their own ideas through guided experiences. This philosophy and practice of teaching, called constructivism, has transformed classrooms and schools across the country into student-centered environments. Students are expected to ask questions and seek new understandings; teachers are expected to

change their roles from providers of information to provokers and guides of student learning. In their paradigm-shifting work on constructivism, Brooks and Brooks delineated the role of the teacher: "Helping students or groups of students to clarify for themselves the nature of their own questions, to pose their questions in terms they can pursue, and to interpret the results in light of other knowledge they have generated is the teacher's main task" (Brooks and Brooks 1993, 30).

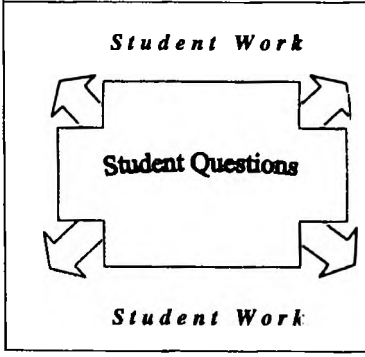
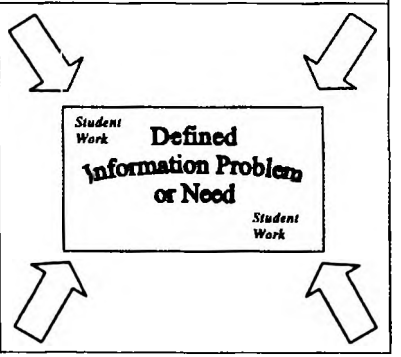
Constructivism seems to be a natural, and long overdue, extension of John Dewey's philosophy that meaningful learning emerges from a series of experiences that have continuity (they are connected one to another and to future experiences) and interaction (they are designed according to the needs and capacities of the learners, and the meaning is derived by the learners as they reflect on and organize the ideas that emerged from the experience) (Dewey 1938, 20, 27, 43, 45–47, 49, 87). Dewey understood that the quality of the experience depended on the environment for learning constructed by the teacher. "An experience is always what it is because of a transaction taking place between an individual and what, at the time, constitutes his environment" (Dewey 1938, 43).

The teacher role defined by Dewey is very much what educators are now calling a constructivist teacher: "It thus becomes the office of the educator to select those things within the range of existing experience that have the promise and potentiality of presenting new problems which by stimulating new ways of observation and judgment will expand the area of further experience" (Dewey 1938, 75).

The learner-centered approach to developing meaningful learning seems to lead naturally to an inquiry-driven philosophy. Dewey's progressive approach established that education should be based on experiences that lead students to hypothesize, explore, reflect, and make meaning. Dewey advocated the scientific method, the most common model of inquiry, as the pattern for designing student experiences: "scientific method is the only authentic means at our command for getting at the significance of our everyday experiences of the world in which we live" (Dewey 1938, 88).

Inquiry is essentially, although subtly, different from an information problem-solving model of student research. Both inquiry and information problem solving are based on a process, a frame for the learning. In a constructivist environment, the frame provided by inquiry more closely matches the principles of constructivism: learning is active, shared, and based on pursuit of student-generated questions; meaning is constructed by the learner; the curriculum is based on big concepts; assessment is founded on student work rather than on teacher-generated tests; and the teacher's role is to interact and mediate the environment (Brooks and Brooks 1993, 17). In an information problem-solving model, the emphasis seems to be more on finding information to answer a problem or need and less on the student's mental processes to learn (e.g., asking good questions, constructing new understandings). Both inquiry and information problem solving result in a research product, but inquiry may be more likely to engender

Figure 1.1
Essential differences between inquiry and information problem solving

INQUIRY	INFORMATION PROBLEM SOLVING
Attitude of questioning and reflecting with cognition	Cognition
Start with question	Start with problem, information need
Investigation is open; student pursuit of answers wherever they lead	Investigation is closed; student pursuit of answers to problem that remains the same
Center is within student; the goal is to develop new understanding within each student	Center is outside student; the goal is to find answers or solutions to external problem
Answers often involve creative building of ideas	Answers often involve selecting and sorting of ideas
Messy, recursive	Planned, linear
Open-ended, leads to future questions, experiences	Closed-ended, results in "final product" or solution
	

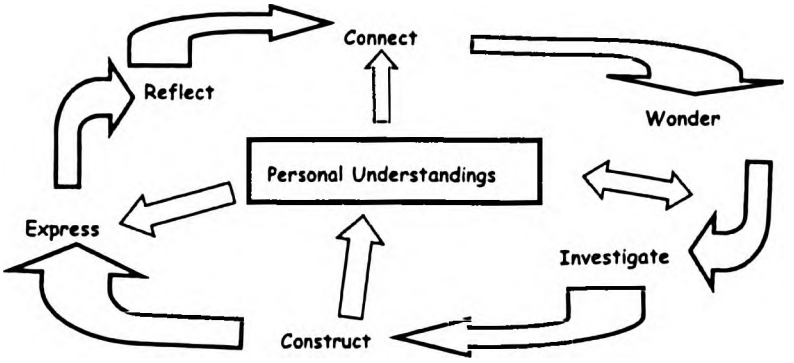
long-lasting, in-depth learning by each individual. Figure 1.1 illustrates some of the essential differences between inquiry and information problem solving.

WHAT IS THE PROCESS OF INQUIRY?

Inquiry is not a collection of process skills and strategies; it is a relationship between thinking skills and content. Learners are, therefore, engaged in scientific inquiry, historical inquiry, social inquiry, literary inquiry, aesthetic inquiry, and other types of inquiry. The overall framework of inquiry is essentially the same for every content area, but the embedded process skills are applied in discipline-specific ways. For example, evaluation of scientific sources might focus on accuracy and reliability of evidence, while historical inquiry might focus more on evaluating sources in terms of point of view and validity of evidence.

A depiction of an inquiry framework provides an overall structure for inquiry-based learning that can be adapted in discipline-specific ways (see Figure 1.2).

Figure 1.2
Inquiry framework



The schema is actually a spiral because each inquiry experience should lead to new understandings and new questions and, therefore, new inquiry.

A linear depiction of the inquiry process allows an analysis of the major skills required for each phase of inquiry (see Figure 1.3).

HOW DOES INQUIRY RELATE TO LITERACY?

A fundamentally important aspect of inquiry is its relationship to reading and writing. Reading involves two main aspects—decoding and comprehension. If students have not unlocked decoding skills, then specific instruction must be given to that end, but even the very youngest readers can also be taught strategies to enhance their comprehension of what they are reading. The reading researcher Jeanne Chall has identified six stages in the process of learning to read that emphasize the importance of teaching comprehension strategies. In Stage Zero, often the pre-school years, children are learning about the basics of language and the purpose of books and print. During the first two years of school, children are in Stage One, in which they primarily focus on the decoding skills of matching sounds to letters and words. During the next two years, grades two and three, most children are in Stage Two, when they have begun to use their decoding skills with more fluency, or reading with speed and accuracy (Clinton 2002, L5).

Unfortunately, reading instruction often stops after the decoding and fluency stages, yet developing increasingly sophisticated reading strategies can continue for a lifetime. Chall has identified three more stages of reading for which students need as much instruction as they require for decoding and fluency. Stage Three, generally from grades four through eight, is the time when students should be expected to focus on building their vocabulary and reading different kinds of prose for different purposes. The switch at this stage is from "learning

Figure 1.3
Linear depiction of the inquiry process

INQUIRY PROCESS
Connect
• Connect to self, previous knowledge
• Gain background knowledge to set context for new learning
• Observe, experience
Wonder
• Develop questions
• Make predictions, hypotheses
Investigate
• Find and evaluate information to answer questions, test hypotheses
• Think about the information to illuminate new questions and hypotheses
Construct
• Construct new understandings connected to previous knowledge
• Draw conclusions about questions and hypotheses
Express
• Express new ideas to share learning with others
• Apply understandings to a new context, new situation
Reflect
• Reflect on own process of learning and on new understandings gained from inquiry
• Ask new questions

to read" to "reading to learn," and students should be taught to find information, determine main points and supporting ideas, and analyze an argument (Clinton 2002, L5). Because the skills to read in this way are often not taught (after all, students are supposed to learn to read by third grade), the long-recognized "fourth-grade slump" has actually become a "fourth-grade cliff" (Clinton 2002, L5).

Students enter Stage Four in high school, when reading should focus on "multiple perspectives." The skills involved at this stage include "weighing evidence, evaluating arguments and making judgments" (Clinton 2002, L5). The final stage in reading development identified by Chall is Stage Five, when adult readers (college age and older) learn to manage their own learning processes. They

are able to select what they want to read for specific purposes, and they are able to find and use the information they gain in order to learn on their own (Clinton 2002, L5). Chall's research recognizes that all of us are continually refining our reading skills and that teachers at all grade levels are responsible for helping students develop their abilities in reading throughout their years of schooling.

Careful scrutiny of the skills required for this comprehension approach to reading reveals important connections between reading and inquiry. Particularly in the stages beyond decoding and fluency, reading and inquiry involve many of the same thinking skills. Strategies that increase comprehension are largely strategies embedded in inquiry (cooperative learning, graphic and semantic organizers, question generating, question answering, summarization) (McREL 2001, 34). For example, the ability to find main ideas is essential for reading comprehension; it is also a key component of inquiry. Reading and inquiry are so closely aligned that one cannot be taught without the other. Students develop their comprehension skills when they want to find answers to their questions and they have to reflect on the meaning of what they find. Students get motivated to read and comprehend challenging text when they are trying to answer an intriguing question and they need information to do so (Santa and Alvermann 1991, 91).

Literacy involves writing as well as reading, and the connections to inquiry are equally strong. "Writing-to-learn" advocates have expounded on the relationship between the thinking skills of writing and inquiry. Research has shown that the most effective focus area for writing instruction is learning and practicing inquiry (McREL 2001, 41). Students develop their inquiry abilities when they are asked to use the structure and context of text (or visuals) to find the main idea, to identify and evaluate supporting evidence, to make inferences, to draw their own conclusions, and to communicate their new understandings to others in writing.

Not only are literacy and inquiry related through common thinking skills, but they both are inextricably related to content. Neither can be mastered out of context (students learn to comprehend and inquire when they are engaged in learning about concepts that matter to them), a relationship stated in the old maxim, "You can't learn process without content." Furthermore, new understandings about content cannot be gained without concomitant teaching of inquiry and literacy skills, or "You can't learn content without process" (Stripling 1995, 164). Teachers must establish an expectation that students will use literacy and inquiry strategies to learn in every content area, because if teachers do not expect students to get information from text, then the hidden curriculum is that reading and inquiry are not important (Santa and Alvermann 1991, 86).

A comparative analysis of the major skills and strategies necessary for inquiry and literacy illustrates the intrinsic connections between the two (see Figure 1.4). A few constructivist strategies for teaching these skills are also highlighted in Figure 1.4.

Figure 1.4
Inquiry and literacy: Connected skills, connected teaching

INQUIRY PROCESS	INQUIRY SKILLS AND STRATEGIES	LITERACY SKILLS AND STRATEGIES	TEACHING STRATEGIES
Connect	Connect to own experience	Relate reading to own life (text-to-self connections) in pre-reading discussions and during reading	Guided imagery Learning logs
	Connect to ideas of others	Use speaking, listening, reading, and writing to share and connect to the ideas of others	Reading and writing workshop Conversation, shared questioning
	Connect to previous knowledge and verify its accuracy	Activate prior knowledge (text-to-world connections)	K-W-L chart (what do you Know, what do you Want to know, what have you Learned) and variations Small-group discussions and dialogues Webbing
	Gain background and context • Discover complexities • Discover areas of particular interest • Develop overview, framework of accurate information	Understand language as a function of context (text-to-text connections) • Develop vocabulary in the context of a discipline • Recognize patterns of text that are used for different purposes	Subject-specific word walls Vocabulary in context (word exploration, concept maps)
		Gain background knowledge to develop a framework for understanding new ideas (text-to-world connections)	Pre-reading aids (visual organizers, structured overviews, semantic maps)

Connect (cont.)	Establish preliminary contact with idea through observation or experience in order to build personal understanding and identify gaps in information or understanding	Observe details of written or visual text to identify current understandings and generate questions	Anticipation guide (statements with which students can agree or disagree) to identify prior knowledge, common misconceptions, key ideas) Concept maps Lectures, textbooks, videos Engagement and exploration activities Observation protocol and log: I Notice / I Know / I Wonder Facilitated conversation to process experience, observations Use of primary sources and artwork for initial observations and discovery

Figure 1.4 (continued)

INQUIRY PROCESS	INQUIRY SKILLS AND STRATEGIES	LITERACY SKILLS AND STRATEGIES	TEACHING STRATEGIES
Wonder	Develop wonder questions that will lead to new understandings about key ideas	Develop questions before reading a passage	Class brainstorming
	Frame questions using: • Context of prior knowledge • Focus and framework of instructional unit, including essential questions • Different levels of thinking, with a push to higher levels (e.g., asking "Why?" and "How?" in addition to asking "What?")	Develop questions to push the level of comprehension: • Ask "Why is this information important?" and "How does it fit with what I already know?" in addition to asking "What does this passage say?" • Ask "What does this passage mean to me?"	Peer questioning
	Develop questions to lead to active investigation and decision making, not to passive information gathering (e.g., "What would happen if . . . ?")	Develop questions that will lead to looking for gaps in information and areas that require interpretation: • Ask "What information has been left out of this passage?" "Why?" • Ask "What is the author's purpose?"	Question stems
	Make predictions or hypotheses based on prior knowledge, background information, and preliminary observations: • Predict answers to wonder questions • Predict what type of information will answer questions (e.g., statistics, narratives, nonfiction resources)	Before and during reading, predict upcoming text, answers to questions	Anticipation Guide

Investigate	Plan investigation and develop search strategies to find relevant, high-quality information (e.g., consider types of sources, types of information, search terms, timeline) Identify, evaluate, and use multiple sources of information • Use criteria to evaluate all sources, particularly non-refereed Web sites • Consider comprehensiveness, format, purpose, multiple points of view, organization of information within source, accessibility, quality and authoritativeness, currency • Seek diverse sources Find and evaluate information to answer questions: • Paraphrase, summarize, interpret, and evaluate information • Find and evaluate main ideas • Find and evaluate supporting evidence, conflicting evidence • Select information to keep or discard • Consider author's point of view and its impact on the information	Identify types of texts and purposes for each Determine reading strategies by type of text Use text structure to extract meaning from text: • Organization of different types of text (e.g., narrative, expository, poetry, drama) • Text patterns (e.g., classification, comparison, explanation, characteristics, justification of thesis, cause/effect, chronology, criticism, problem/solution) • Text organizers (e.g., chapters, headings, subheadings, bold, italics, boxed information) • Graphic information (e.g., pictures, charts, maps, graphic representations) Use global reading strategies to extract meaning from text: • Skim, scan, read for main ideas, read for details • Paraphrase • Summarize • Generate questions while reading • Distinguish between main ideas and topic	Questioning the author Time for independent reading and investigation Think-aloud by teacher Frames (visual representations) of important content in text. Teacher can fill in main ideas beforehand, class can fill in together during class discussion, students can fill in individually as they read. • Problem-solution • Main idea, details • Theory, evidence • Question-answers • Comparison/contrast • Chronological sequence • Explanation, evidence, examples Modeling of use of strategies by teacher Read-aloud, Inquire-aloud Guided practice

Figure 1.4 (continued)

INQUIRY PROCESS	INQUIRY SKILLS AND STRATEGIES	LITERACY SKILLS AND STRATEGIES	TEACHING STRATEGIES
Investigate (cont.)	• Distinguish among facts, point of view, and opinion • Detect bias, inaccuracy	• Use cues for finding main ideas (e.g., signal words, topic sentences) • Determine author's point of view	After each paragraph, students summarize main idea and write a question about it
	Take notes using a variety of formats (e.g., learning logs, graphic organizers)	Use a variety of reading response formats to aid in extracting meaning and generating interpretations of text (e.g., reading response journals, graphic organizers, two-column response logs)	Students make graphic organizers Students create semantic maps
	Use information and information technology responsibly, efficiently, and ethically (e.g., responsible use of the Internet, no plagiarism, no violations of copyright)	Monitor own comprehension	Students make marginal notes Students draw pictures Response journals
	Think about the information to formulate new questions, hypotheses • Identify gaps and conflicting information • Consider alternative explanations and predictions • Consider new questions to extend the investigation into a new area	Make new predictions, ask new questions to lead to further reading	Two-column notetaking: • Notes / Reflections • Main Idea / Details, Examples • Ideas from Text / Connections to Prior Knowledge

Construct	Organize information to detect relationships among ideas Draw inferences justified by the evidence Think about the information to test predictions and hypotheses: • Compare evidence to hypotheses • Compare patterns in data with what is already known • Use evidence to construct reasonable explanations • Connect results with larger body of knowledge Recognize authors' points of view and consider alternative perspectives Construct clear and appropriate conclusions (new understandings) based on evidence, explanations, interpretations, and connections to the world of ideas and human experience Connect new understandings to previous knowledge to be sure that old, inaccurate, and naive mental models have been modified	Use visual literacy to organize ideas and extract meaning from different formats of text (e.g., illustrations, graphics, layout) Interpret the meaning of the text: • Test against predictions • Find patterns and relationships among ideas in the text • Identify new information and compare to prior knowledge • Make inferences based on information explicit in the text; use evidence from the text to support inferences Recognize authors' points of view and consider alternative perspectives Draw conclusions about the meaning and implications of the text, using supporting evidence from the text Connect reading to own experience (text-to-self), previous knowledge and the real world (text-to-world), and previous reading (text-to-text) Compare new ideas with ideas previously held	Use *Visual Tools for Constructing Knowledge* to provide visual organizer templates and advance organizers to help students organize thinking and discover patterns and relationships in information Questioning: Teacher-to-student, student-to-teacher, student-to-student Class discussion Quick writes or directed writing of interpretations on specific questions or specific sections of text Cooperative learning: Shared inquiry, shared reading, interactive writing, peer review of writing Reciprocal teaching Comparing evidence to hypotheses to generate new explanations: Evidence that Supports / Evidence that Refutes → New Explanation Record → Elaborate → Extend

Figure 1.4 (continued)

INQUIRY PROCESS	INQUIRY SKILLS AND STRATEGIES	LITERACY SKILLS AND STRATEGIES	TEACHING STRATEGIES
Express	Apply understandings to new context, new situation—create a product to demonstrate new understanding Select format based on needs of topic and audience Communicate clearly both main and supporting points in product Use the writing process to develop product (pre-write, write, revise, edit) Evaluate and revise own product based on self-assessment and feedback from others Express new ideas or take action to share learning with others: • Communicate procedures and explanations for outcomes • Communicate conclusions and evidence for them • Communicate interpretations and evidence for them • Respect diverse opinions and alternative explanations, but defend own conclusions with evidence	Use appropriate format to communicate understanding Select format based on needs of topic and audience Select an organizational pattern based on needs of topic and discipline (*Writing in the Content Areas*): • Classification • Comparison • Characteristics • Justification of thesis (position paper, interpretation, cause/effect, statistical) • Chronology • Claims and causes • Causes, consequences, and conditions • Criticism Use the writing process to develop product (pre-write, draft, revise, edit, publish) in any format (e.g., written, presentation, visual, Web page)	Writer's workshop Use of graphic organizers in pre-writing and writing stages Reciprocal teaching Literate conversations (e.g., literary circles, discussion groups) Use of rubric with specific criteria Student collaboration to assess the strength of arguments (Believe / Doubt) (Jacobs, 2000) Debates

Express (cont.)	• Communicate to make thinking clear to others • Communicate to persuade others to adopt a point of view or interpretation	Evaluate and revise own product based on self-assessment and feedback from others	Teacher and peer conferencing
Reflect	Set high and clear standards for own work	Use specific criteria in rubrics to assess the quality of the final product	Metacognitive strategies
	Reflect with others	Use feedback from peers and teacher to assess own work	Students assess own progress in skills, content learning
	Use criteria to assess own process and product throughout the learning; make revisions when necessary		Feedback that is corrective, timely, specific to a criterion, self-generated, and generated by teacher and peers (Marzano et al. 2001, 92–102)
	Reflect on own learning to be clear about the change in understanding (change in mental model)	Identify new understandings and new questions	Reflection log: • I Used to Think / But Now I Know
	Adapt own standards and process based on personal reflection and feedback from others		
	Ask new questions, set new goals for learning	Set new goals for reading, writing, speaking, and listening	Portfolio reflections
			Student-written individualized learning plans

WHAT IMPACT DOES INQUIRY-BASED INSTRUCTION HAVE ON CURRICULUM DEVELOPMENT?

Most educators agree that "curriculum" has a somewhat elusive definition. Some would claim that curriculum is defined by national standards in the content areas. If that were so, then "schooling would have to be extended from kindergarten to grade 21" to teach all of the ideas included in the standards, according to researchers Marzano and Kendall (1999, 104). E. D. Hirsch, considered by many educators as a proponent of a curriculum a "mile wide and an inch deep" because of his Core Knowledge lists of topics, actually recognizes that the curriculum should balance broad knowledge and deep understanding: "We should teach a diversity of subjects that will lead to broad general knowledge, and we should also teach in some depth a moderate number of specific examples" (Hirsch 2001, 23).

Inquiry-based learning is the opportunity for students and teachers to pursue important ideas in depth. A curriculum that supports inquiry-based learning would probably delineate a broad, general framework and context and help the educator identify in each discipline the essential ideas that students need to understand in depth. Grant Wiggins and Jay McTighe, in their important book *Understanding by Design*, have come the closest to helping define the scope of an in-depth, inquiry-based curriculum by suggesting three levels of priority for curriculum content—Worth Being Familiar With, Important to Know and Do, and Enduring Understanding. The filters they offer for educators to use in determining ideas to teach for Enduring Understanding coincide very strongly with an inquiry-based approach to curriculum: (1) Is it a big idea that has value beyond the classroom? (2) Is the idea at the heart of the discipline? (3) Is the idea complex enough that it requires uncoverage? and (4) Will the idea engage students? (Wiggins and McTighe 1998, 10–11).

No matter what ideas are included in the written curriculum, every teacher knows that the written curriculum is translated into the taught curriculum, which is further translated into the learned curriculum. Research shows that students learn by doing; therefore, if the curriculum is designed as a coherent plan of student experiences, then the confluence between the written and learned curriculum should be at its maximum, whatever the content of the written curriculum.

In *Teaching for Thoughtfulness*, John Barell advocates designing curriculum around a coherent plan of inquiry-based experiences:

> Curriculum development can be conceived as that process whereby we design experiences whose purpose is to introduce students to the stories of our subject matters. All subjects have within them stories, since these subjects or areas of inquiry are human creations. The humanities, mathematics, sciences, and the practical and performing arts are ways we hu-

> mans have of investigating the world and the universe, ways of searching for and fashioning meaning. (Barell 1995, 131)

Barell suggests that the ideas within a curriculum must be robust, have significance to cultural values and society, meet student interests and needs, and offer the potential for continuity (vertical through the grades) and transfer (Barell 1995, 135–138).

The vision of curriculum offered by Barell, Dewey, Wiggins, McTighe, and many other educators and researchers is that of a spiral of essential ideas that students investigate with more complexity and depth each time they encounter them. Such a curriculum, if it is inquiry-based, provides a framework for the development of long-lasting conceptual understanding.

In 1975, the Ontario (Canada) Ministry of Education, using an inquiry-based, constructivist approach to curriculum and instruction, issued curriculum guidelines for elementary and junior high schools that included questions to be used to judge and shape curriculum content (Brown 1991, 209):

- Will it give children an opportunity for direct inquiry, independent study, and creative ability in the context of their own interests, abilities, and developmental needs?
- Will it fulfill their needs to explore and to manipulate?
- Will it satisfy the search for patterns?
- Will it relate to what the children already know?
- Will it be sufficiently novel to stimulate questions, observations, and manipulations?
- Will the children be able to see what they are learning as part of an organized and meaningful whole?
- Will it spring from real experiences in the children's environment?
- Is it appropriate to each child's level of development?
- Will the children be able to know when they've been successful?
- Will it provoke questions, involvement, a desire for further exploration?
- Will it encourage learning through play?
- Will it provide experiences with qualitative relationships?
- Will the content provide opportunities for various techniques of investigation?
- Will it be socially useful?

Once a decision has been made to organize curriculum and instruction around inquiry, a second aspect of curriculum must be considered—organization by disciplines. With an increasing focus on high achievement in literacy and math,

educators in elementary and middle schools are feeling the pressure to abandon discipline-specific learning, especially in the sciences and social studies. However, Howard Gardner, in *The Disciplined Mind* and *Schools That Learn*, provides a solid and impassioned plea for the value of discipline-based curriculum: "At any given moment, the disciplines represent the most well-honed efforts of human beings to approach questions and concerns of importance in a systematic and reliable way" (Gardner 2000, 144; Senge et al. 2000, 555–566). Gardner contends that the main issues of humankind throughout history have been truth, goodness, and beauty and that these are systematically addressed through the disciplines of math and science (truth), the social sciences (goodness), and the arts (beauty) (Gardner 2000).

Although Gardner recognizes that the questions that students ask often go beyond discipline boundaries, he presents a strong case that students need to use discipline-specific ways of thinking to discover in-depth answers to their questions and make sense of the world. Answers to scientific or mathematical questions need to be based on truth about the natural world, derived from scientific theories and evidence. Scientific answers, though, are essentially different from historical conclusions. Investigations in history are based on interpretation and point of view, and they involve human motives and conditions. The social-science perspective leads to judgments about right and wrong, cause and effect, problem and solution, based on analysis of the evidence and recognition of the human context for every situation. The arts perspective uses imagination, thoughts, and feelings to communicate about the experience of beauty.

Curriculum for Gardner is the creation of K–12 pathways to understanding founded on questions that are fundamental to human experience, questions such as "Who are we?" "What do we consider to be true/false, beautiful/ugly, good/evil?" "What is love?" "Why do we make war?" "What is justice and how do we achieve it?" (Gardner 2000, 216). These questions can be posed and reposed for student investigation in developmentally appropriate ways—through fairy tales with kindergartners, mythology with seventh graders, Shakespeare with high schoolers. The pathways provide a focus on essential ideas for the curriculum, an opportunity to investigate issues in discipline-specific ways, and a spiraling of learning as students develop their capacities. Gardner affirms the importance of the disciplines in helping children make sense of the world: "The purpose of disciplinary study in the precollegiate years is not to develop miniature scientists, historians, or aestheticians. Rather, the goal is to make youngsters comfortable with the intellectual core, the analytic power of several ways of approaching the world" (Gardner 2000, 218–219).

Because of the power that Gardner and others have identified in disciplinary thinking, these educators have issued a caution about interdisciplinary studies. Interdisciplinary does not mean that the disciplines disappear. Gardner says that there is great value to studying a common theme through the lens of different disciplines as long as the strengths of each discipline's approach are not blurred

(Gardner 2000, 221) (e.g., an overarching topic like the Middle Ages seen through the eyes of a scientist, artist, mathematician, or historian).

Heidi Hayes Jacobs, in her book *Interdisciplinary Curriculum: Design and Implementation*, also recognizes that each discipline has different ways of thinking, using different questions and different patterns of reasoning. Familiarity with disciplinary thought patterns helps students see the relationships among ideas and learn efficiently. Jacobs is concerned, however, that educators never let students in on the secret about disciplinary thinking. Children regard social studies as "the time after lunch" rather than the systematic investigation of people and how they relate to one another. In advocating interdisciplinary teaching, Jacobs pleads for the preservation of disciplinary thinking together with the search for meaningful linkages among disciplines (Jacobs 1989, 8). For instance, in an integrated curriculum, students might investigate the theme of "conflict" in history, science, literature, and the arts. How is conflict between humans different from conflict in the natural world? What can humans learn from the scientific perspective on conflict? How could the resolution of conflict in music inform our writing of short stories?

Curriculum in an inquiry-based classroom, then, is based on essential ideas and ways of thinking in different content areas. Curriculum is "uncovered" rather than "covered" as students ask questions and actively investigate the answers. Although the key content ideas remain as a stable framework for each discipline, the path to those ideas is constructed by each learner and guided by the teacher.

WHAT DOES DISCIPLINE-BASED INQUIRY LOOK LIKE, AND WHAT RESOURCES ARE REQUIRED?

Teachers who have specialized in a particular content area are familiar with the key ideas and thinking strategies needed to understand that subject. Most librarians and elementary teachers, however, have not focused on a particular discipline and may find it difficult to think like a historian or an artist. If teachers and librarians plan to integrate inquiry throughout the curriculum, then some thought must be given to the ways inquiry differs in the different discipline areas.

Although classroom teachers are primarily responsible for students' developing understanding of specific disciplines, librarians can provide valuable support by emphasizing discipline-specific inquiry and literacy skills in their collaborative instructional design and teaching.

Science

Science is the study of the natural world. Curriculum study projects by the American Association for the Advancement of Science, the National Science Teachers Association, and other groups emphasize that the study of science must be based around essential concepts that scientists use as frameworks to view

and think about the natural world. Most lists include diversity; variation; systems, order, and organization; form and function; and stability and change (Sivertsen 1993, 8). An elementary student studying plants might investigate how the form of a cactus allows it to survive in desert conditions (function). Another student might use the essential concept of diversity as a lens to raise the level of research about plants in the desert from fact-gathering (What are all the plants that live in the desert?) to inquiry-based investigation (How are the plants that live in the desert different from and similar to each other? How do those differences cause different responses to their environment?).

Students who are engaged in science inquiry are searching for the truth, for explanations about the physical world that are based on accurate and replicable evidence. The driving question for scientific inquiry is "How?" Students develop an answer to "How?" through scientific investigation, whether they are conducting their own experiments or reading about the experiments of others.

Teachers and librarians who are facilitating students' inquiry in science need to tailor their instruction and support in several ways:

1. Because everyone lives in the natural world, everyone develops personal theories about how the world works. Many of these theories are actually scientific misconceptions (e.g., heavy objects always fall faster than light objects). Teachers and librarians at all grade levels must give special attention to activating students' prior knowledge in science in order to identify the students' misconceptions. Unless students confront their wrong ideas, they rarely change them, even when they are "learning" conflicting (more accurate) information.
2. Development of a sound hypothesis is a key element in focusing the inquiry. The hypothesis combines the students' questions with their prior knowledge and background information to predict the way the world will work in a given situation. Teachers and librarians should make sure each student has a sound hypothesis before proceeding further (i.e., a hypothesis that could be true, could be tested and replicated). Even early elementary students can develop hypotheses with teacher support and scaffolding.
3. The sources used for scientific inquiry should be evaluated based on scientifically important criteria. Elementary students might focus on currency, learning that the source should be as current as possible because scientific knowledge builds and changes as techniques improve and new discoveries are made. Middle school students might evaluate the credibility of the source. The author and publisher should be authoritative, with a reputation for publishing sound scientific reasoning. High school students might evaluate the extent of bias, recognizing that a scientific source should be unbiased so that a complete picture of the data is made available.

4. The criteria for judging scientific evidence should be accuracy, logic, reliability, replicability, and clarity of presentation, with different criteria emphasized at different grade levels. Unlike historical evidence, scientific facts should remain true no matter who conducts the experiment, where the experiment takes place, or how often the experiment is conducted. The evidence should lead to a reasonable explanation and should confirm or refute the hypothesis. Conflicting evidence and alternative explanations should be pursued until the reason for the differences is clearly established and the line of evidence leads to a concluding explanation.
5. Visual literacy, especially important for scientific inquiry, is a set of skills valuable for any age or grade. Data that are found in charts, tables, and other visual media must be interpreted correctly. Students should also be encouraged to create their own visual presentations to express their conclusions and evidence to others.
6. Developmentally appropriate vocabulary specific to a scientific context must be taught through a variety of contextual strategies. Words that may have a number of meanings in regular text may take on very specific definitions in science. Visual representations of the concepts should accompany verbal definitions whenever possible (Marzano et al. 2001, 123–129).
7. Text structures in science should be taught to the students when they are appropriate for the scientific concepts being studied. A number of the most common patterns are: hypothesis-evidence-conclusion; topic and subtopic; classification; steps in a process; assertion and support; comparison/contrast.

Math

Math is the study of patterns and relationships in the natural world. The science question "How?" also drives math inquiry. The focus is on finding the truth, on finding number patterns that describe the physical world. Math, perhaps even more than science, is immutable. A truth in math exists outside of who and why and where. If a pattern exists, it exists everywhere and for all time (unless new truths are discovered).

The National Council of Teachers of Mathematics has identified major concepts that define the field of mathematics: number sense and operations; systems; patterns, relationships, and functions; geometry and spatial sense; measurement; probability and statistics; and algebraic concepts and operations. Just as in science, students can use these concepts as organizers for their thinking. For example, students finding geometric patterns in architecture might assess the spatial sense or aesthetic effect when different patterns are used (e.g., How is

the sense of space different when one stairway is curved and another is linear?), rather than just describe the patterns themselves.

Although students generally do not go to the library to conduct inquiry in math, librarians and classroom teachers should make sure that a learning environment conducive to math inquiry is created:

1. Students of all ages should be taught visual literacy. In math, not only is much of the information contained in numbers and symbols, but also the specific position of those symbols determines the meaning.
2. Vocabulary specific to a mathematics context is important. Even common English words, like "slope," have very precise mathematical definitions. Visual depictions of mathematical concepts are very important to the learning of math vocabulary.
3. Because mathematics tends to be abstract to most students, teachers and librarians should help students connect mathematical concepts to the real world. This is particularly important for younger students who have not fully developed their abstract thinking. Assignments that help students discover arithmetic progression patterns in nature, for example, will increase students' depth of understanding of both math and science. Understanding voting patterns in mathematical terms brings mathematics into the social studies classroom and the real world of elections.
4. Text structures in mathematics, from elementary texts through high school, tend to be very dense in conceptual content, precise in language, and organized in a variety of ways different from those of common expository text. Information may be presented right to left (number lines), top to bottom (tables and charts), and even diagonally (graphs) (Barton et al. 2002, 25). Instead of the typical topic sentence-evidence-example structure, mathematics texts may build evidence point by point and end with the main idea. Other common text structures for mathematics include main idea-details, visual texts, concept and definition, and steps in a process. When students understand the text structure, they are better able to use the text to extract information.
5. Students of all ages should be encouraged to vary their speed and slow down to "read" mathematics material. Because one section of a mathematics text builds on the next, students must monitor their comprehension at each step. Even the prepositions are important in mathematical inquiry.

Social Studies

Inquiry in social studies is very different from inquiry in mathematics and science. The field of social studies concerns the study of human interaction with

the world and with other humans. The focus is on values and behavior rather than the "truth." Inquiry in social studies tends to ask, "Why?" "Who?" "Where?" "How good or bad?" and "What consequences?" In math and science, the same set of circumstances leads to the same result; in historical inquiry, the same set of circumstances seen through a different point of view or from a different cultural perspective might lead to widely divergent interpretations. Instead of searching for one truth, social scientists search for truths interpreted through multiple perspectives.

Although national professional organizations in social studies have offered competing sets of standards, the National Council for Social Studies has identified some concepts that form the framework of most social studies curricula: culture; time, continuity, and change; people, places, and the environment; individual development and identity; individuals, groups, and institutions; power, authority, and governance; production, distribution, and consumption; science, technology, and society; global connections; and civic ideals and practices (Zemelman et al. 1998, 138–139). History, a subsection of social studies, can be interpreted through even more specific lenses: time, place, viewpoint, exploration, causation, biography, and precedent (Lile 2001, unp.).

As students are conducting inquiry into questions about culture, individuals, and society, they carry a heavy responsibility for integrity of their thinking. The evidence that they find is either a primary source that they must interpret accurately or a secondary source that is an interpretation written by someone else. The interpretations invariably involve value judgments, and the evidence offered has been selected to confirm the author's perspective. Particularly in secondary schools, it is incumbent upon the students to seek multiple perspectives before arriving at a conclusion of their own. Librarians and classroom teachers must emphasize the inquiry skills and strategies that enable students to inquire with integrity into the study of society:

1. Background information (social and historical context) is essential because every individual and group is influenced by the context. Unlike in science, variables cannot be completely controlled, so their impact must be considered. If a class is studying the factors that led to the American Civil War, then students must learn about that time in America from many perspectives. Because no one student could pursue all perspectives on his or her own, this presents an opportunity for cooperative learning and sharing through class discussion. For example, elementary students can work in groups to investigate what soldiers, slaves, politicians, and young people said and did during the Civil War. As each group shares with the class, students begin to understand multiple perspectives.
2. Students' misconceptions in social studies may be as strong as they are in science; therefore, it is important to activate students' prior knowledge and assumptions because they can enhance or retard learn-

ing. For example, students might assume that everyone in the South favored slavery and that everyone in the North opposed it. Confronting students' assumptions is a valuable way to lead to engaging inquiry questions.

3. Evaluation of sources is critical to inquiry in social studies because of the interpretive nature of the discipline. Students should assess the value of a source before they even look at the specific information within the source. If teachers or librarians have selected the source, then they should share their thinking process with students. The criteria that need to be emphasized (at age-appropriate times) are authoritativeness of the author/publisher; comprehensiveness of the information (students are seeking in-depth information, not collections of superficial facts); organization and clarity of the text (students need to be able to find and comprehend relevant information without getting lost in extraneous links or subtopics); and quality of the references (the sources of the cited evidence). Obviously, in the age of the Internet, responsibility for evaluation of sources has largely shifted from librarians to students. Careful instruction and guidance must accompany that shift.
4. Use of primary sources is an important component of inquiry in social studies. Students must be taught to observe and draw valid interpretations from artifacts, ephemera, images, maps, and personal accounts. Students must be taught to interpret the primary source in light of its context (e.g., a soldier writing a letter about a recent skirmish may think it the bloodiest battle of the war because he was injured; a photographer shooting a peace march from a low angle may convey a huge crowd, while an overhead shot might show a small crowd with empty streets behind it). Because so many sources are being digitized, students have more access to primary sources than they have ever had before. Primary sources may be particularly exciting to elementary students who have limited background knowledge. They, therefore, need scaffolding to foster the validity of their interpretations.
5. Evaluation of specific information and evidence is also a key thinking strategy for inquiry in social studies. Librarians and classroom teachers probably want to emphasize discernment of fact versus opinion and help students understand how each can be used effectively. Students, particularly at the secondary level, must learn how to identify point of view and recognize its effect on the evidence. Their responsibility is to find enough evidence from different points of view that they achieve a balanced perspective. Sources that present opposing viewpoints are helpful to provide that balance of evidence. Secondary students must also be taught to detect degrees of bias (from slightly slanted point of view to heavily slanted propaganda).

6. Because the path from evidence to conclusion is not as clear as in scientific inquiry, students at all ages must be taught to examine the evidence critically, to infer relationships among ideas (e.g., cause and effect), and to combine critical concepts to draw clear and appropriate conclusions. Students must also provide specific and supportive evidence to back up their conclusions.
7. The use of graphic organizers for note-taking and for organizing the information in order to draw conclusions should be taught to all students. Students can be offered graphic-organizer patterns for cause and effect, main idea and supporting evidence, comparison/contrast, chronological sequence, and point-of-view analysis (Marzano 1992, 43–47).
8. Reflection must be taught as a critical component of investigation. Students need to monitor their own comprehension, their connections to prior knowledge, their recognition of point of view, and their continuous questioning and interpretation of the evidence. Numerous scaffolded opportunities for reflection can be built into the inquiry process (e.g., peer think-alouds, learning-log note-taking, quick writes, research journals).
9. Text structures in social studies tend to follow several patterns—chronological order, main idea and details, cause and effect, and compare and contrast. Students should be taught to identify the text structure and select the material organized most effectively for their own inquiry. For example, a student pursuing the development of the role of children in society might be well served by a chronological text structure. Another student who wants to look at the gender gap in high school mathematics and science would be extremely frustrated by chronologically arranged text.
10. The availability of a library is essential to inquiry in social studies from kindergarten through twelfth grade. Students must have guided access to materials that offer a wide variety of text formats, multiple perspectives, various reading levels, in-depth information, and both primary and secondary sources. As information continues to explode, the organization, instruction, and scaffolding provided by the librarian are necessary for effective and efficient teaching and learning.

Language Arts and Literature

Language arts is more process- than content-based, with a focus on reading and literature, writing, language study, speaking, listening, mass media, and information processing (Glatthorn 1998, 159–160). Traditionally, language arts classes have focused on narrative literature. Language arts teachers have taught the narrative structure of novels, short stories, poetry, and drama. They have

helped students learn to interpret narrative text based on an analysis of human behavior, relationships, emotions, and attitudes in the context presented in the text. While inquiry might inform and provide background to students' interpretations, the focus of thinking and the collection of evidence always have to originate and end in the narrative text itself.

Perhaps because of the increasing national emphasis on accountability and high-stakes testing and recognition of the type of informational reading most adults engage in throughout their lives, educators have begun incorporating more nonfiction into their expectations for student reading and writing. That has opened the door to inquiry in the language arts classroom. Although at times students may conduct inquiry into literature, language history, or communication, inquiry in the language arts classroom is often opened to student choice of any subject that intrigues them. With the diversity of inquiry questions, the teaching emphasis during inquiry in language arts classes is primarily on process skills and strategies. Because students are not so tightly bound by specific content goals, inquiry in the language arts setting may provide the best opportunity for students to pursue investigations that are personally meaningful to them. Language arts inquiry also opens opportunities for substantive interdisciplinary teaching, with an integration of key ideas from subject-area content and key strategies from language arts processes.

Inquiry in the language arts classroom provides valuable opportunities for teaching integrated literacy and inquiry skills (see Figure 1.4):

1. Research about reading has identified several thinking skills that provide the essential core of effective reading and writing as they spiral through the grades. These include questioning, finding main ideas and details, summarizing, interpreting, making inferences, determining the importance of ideas, identifying the author's purpose, and synthesizing. All of these are embedded in inquiry.
2. It is important to recognize that each step of the inquiry process is essential but that students do not have to perform each step for every inquiry assignment. For example, if classroom teachers and librarians are emphasizing the evaluation of an author's point of view, they might scaffold the search for resources by providing a pathfinder. Elementary students in particular benefit greatly when teachers focus on the acquisition of one skill at a time and scaffold the rest.
3. As a part of integrated literacy/inquiry teaching, classroom teachers and librarians should help students recognize and derive meaning from different text structures. Nonfiction texts may be organized by main idea and details, opinion supported by evidence, comparison/contrast, cause/effect, sequential or chronological order, opposing viewpoints, and topic and subtopics. By introducing different text structures at developmentally appropriate times, teachers and librarians can help students

learn to use text structure as a criterion for selecting appropriate resources and as a key to unlocking the meaning of text.

4. Related to analysis of text structure is use of graphic organizers. Virtually every student benefits from developing a schema for information. Graphic organizers are particularly useful to students with reading or language barriers. Numerous books and computer programs on graphic organizers are available to help both students and teachers (Hyerle 1996, 2000).

HOW IS AN ENVIRONMENT OF INQUIRY CREATED AND SUSTAINED?

Inquiry demands a constructivist approach to teaching. Ideally, students are expected to take charge of their own learning and to pursue questions to reach in-depth understanding. Teachers are expected to support and challenge as they guide the students through inquiry experiences. The ideal sounds wonderful. Unfortunately, however, most teachers have had limited experience with inquiry themselves, and they may have little confidence in their ability to guide students through the process, even if they are committed to the idea that inquiry-based student learning is powerful and long-lasting.

When teachers in a school make a commitment to inquiry-based instruction, the best way to support their deep understanding and classroom implementation is to surround them with a schoolwide environment of inquiry, including embedded, inquiry-based professional development. Everyone in the school must understand inquiry in all its complexity and must be committed to its implementation throughout the school. By creating a holistic environment that supports inquiry, educators move toward their ultimate goal—a schoolwide community of inquiry.

Research about learning has shown that teachers build an effective learning environment by concentrating their efforts in four areas: the learner, knowledge and curriculum, assessment, and community (Bransford et al. 1999; National Research Council 2000, 121–124). Teachers trying to construct an environment that supports inquiry can address the same four areas but focus on strategies that have proven to be effective in inquiry. When teachers work together, they can create a schoolwide community of inquiry.

Learner-Centered

A learner-centered inquiry environment is responsive to divergent individual needs and questions. Those needs are met by a coherent (across the school, across the grades) approach to teaching inquiry and literacy skills in order to help individuals become independent learners who take ownership and responsibility for their own learning. The schoolwide infusion of inquiry and literacy

skills into every content area provides substantive support to individual learners, especially those with learning difficulties who need extra help in unlocking content (e.g., English language learners, students reading below grade level).

Learner-centered environments also foster the development of interdependence among learners by providing opportunities for collaboration. A schoolwide emphasis on conversation and dialogue sets an expectation that students and teachers are learning together. Indeed, Vygotsky recognized that students learn first from dialogue with others and then develop deep understanding from individual internalization based on those conversations (Fogarty 1999, 77).

Not only must learners be both independent and interdependent, but in environments that focus on learners and inquiry, learners must be both active and reflective. Schoolwide indicators of active learning would be interactive classrooms, a dynamic and totally integrated library program, a focus on student work, and opportunities for learning beyond the classroom (e.g., community service projects, school gardens, historical research in local museums, documentary filmmaking, community oral history projects). At the same time, schools should provide opportunities for reflection by requiring a reflective component to all student work, providing time for both students and teachers to reflect on their goals and successes, and inviting parents and students to join the educators in assessing the effectiveness of learning in the school.

Learner-centered schools promote inquiry among teachers as well as students through inquiry-based professional development. When teachers are actively engaged in asking questions and investigating answers about their disciplines and their practice, they become active and reflective participants in the inquiry-based environment (Cushman 1999, unp.).

Knowledge-Centered

School environments that foster inquiry provide a coherent approach to knowledge that links the in-depth learning in each classroom to other classrooms and to the future. Educational researchers have touted a K–12 curriculum plan (e.g., a spiral or discipline-specific pathways) to enable all learners to engage with ideas at their level of development, to connect to their prior knowledge, and then to build the accuracy, complexity, and sophistication of their ideas. Educators, students, and parents must see that the knowledge embedded in one year's experiences leads to the next year's and the next year's, that there are no critical gaps in the curriculum plan, and that students who graduate are prepared for their futures.

In 1989, the American Association for the Advancement of Science identified five criteria for curriculum content that would provide coherent preparation to all students for life after graduation (Nelson 2001, 13):

- *Utility.* Will the knowledge and skills be useful to the students in their work and daily lives?

- *Social Responsibility.* Will the knowledge and skills help students exercise their rights and responsibilities as citizens?
- *Intrinsic Value of the Knowledge.* Is the knowledge significant either historically or culturally?
- *Philosophical Value.* Does the knowledge contribute to an understanding of the human condition?
- *Childhood Enrichment.* Will the knowledge and skills enhance the childhood years?

Knowledge-centered schools need not only to provide a coherent approach to the curriculum but also to offer an environment that is rich with access to learning resources that support inquiry learning. The multiple resources and varied perspectives provided by school libraries are essential to inquiry-based learning. Administrators, librarians, teachers, and students must understand that organizing a library around inquiry requires decisions that provide maximum support for in-depth, content-based learning (e.g., a flexible schedule that allows access when students and teachers need it; selection of resources that provide balanced and in-depth points of view about curricular ideas).

Assessment-Centered

Researchers have suggested that the third area of focus for creating inquiry-based environments is assessment. Assessment during inquiry has moved way beyond the traditional "teacher-assigning-a-grade-at-the-end-of-a-unit" definition. Assessment involves looking at the learning throughout the learning experience: before (e.g., identifying prior knowledge to allow measurement of growth in understanding); during (e.g., making sense of new information, asking questions, recognizing gaps and inaccuracies in knowledge); and after (e.g., evaluating the progress in understanding and the final product).

Inquiry-based assessment not only occurs throughout the process of learning but also involves the whole community of learners. Students are expected to reflect on their own learning on a daily basis through learning logs, journals, reflection questions, and other techniques. Peers provide support and feedback through peer-to-peer reviews, dialogues, classroom conversations, revision groups, interactive writing, and many other strategies. Teachers use varied methods to check their students' progress and diagnose their needs such as class checks, quick writes, consultations, and class conversations (National Research Council 2000, 122). Students, peers, and teachers all rely on rubrics and checklists to provide feedback on drafts of final products.

The definition and expectations for assessment in a schoolwide environment of inquiry have moved to authentic assessment. Newmann and his colleagues have defined authentic assessment as an outgrowth of authentic achievement using three criteria (Newmann et al. 1995):

- The assessment itself provokes construction of knowledge, not just spitting back facts (e.g., students may be asked to apply what they have learned to a new situation);
- The assessment requires the disciplined use of process skills (e.g., students would be expected to use higher-order thinking skills, to follow the inquiry process, to work a piece of writing through the entire writing process);
- The assessment is connected to real life and has a value beyond school (e.g., students are expected to relate their new understanding to their prior knowledge and to their understanding of the way the world works).

Community-Centered

Environments that support inquiry must be centered on building the community itself as much as they are focused on the learners, knowledge, and assessments. In fact, a sense of community may be the most important aspect of a schoolwide environment of inquiry. Communities of all types are composites of diverse perspectives and personalities. That diversity creates a tension between sometimes conflicting forces within the community.

School communities also must deal with the tensions that arise from diverse perspectives, competing goals, and time deadlines. Individual needs and interests that drive the independent learning of inquiry do not easily subsume themselves to the interdependent needs of the group. Teachers have to maintain a fine balance between allowing students to pursue their own questions and maintaining the overall focus on the key ideas and essential questions of the curriculum. Even the timing of inquiry produces a tension between moving along through the steps of inquiry and allowing the questioning and recursiveness of discovery.

Probably the most difficult balance for teachers to maintain is in their own facilitation of the learning process, because they must both challenge and support the learner. If Vygotsky's theory about the Zone of Proximal Development (ZPD) is correct, then students reach their highest potential in development only when their thinking has been confronted and pushed to a higher level by others (Watson and Kopnicek 1990, unp.). Teachers must ask challenging questions and push students' thinking, even though it seems counterintuitive to the traditional definition of teacher as facilitator and support-provider. Learners must also challenge each other and hold each other responsible for the learning in the classroom (Mills and Donnelly 2001, 157). An inquiry-based classroom should provoke students into taking risks, with the possibility of failing to ask the best questions or pursue the appropriate answers at first but with the goal of learning from those experiences and re-engaging in the process.

A community of inquiry balances academic challenge with academic support. Teachers use a variety of techniques to offer support, including teaching appropriate inquiry and literacy strategies, offering access to multiple resources that

are written at comprehensible levels, pairing or grouping students for peer support, offering scaffolding throughout the inquiry process, and even engaging parents and community members as partners in the students' learning. Academic support does not mean setting lower expectations so that students can easily meet them. Students must be challenged to set high learning goals; the community must offer support to help them reach those goals.

Teachers who are building communities of inquiry create personal support as well as academic support for their students. In a community of inquiry, all members learn to listen to and respect the voices of others. Students become empowered as individuals with ideas to express to others. Through shared learning, students get to know one another and develop a network of caring and thoughtful relationships. With practice, collaboration becomes integral to the learning process. The classroom becomes a microcosm of democracy in which the members take responsibility for weaving diverse perspectives into a collective vision (Mills and Donnelly 2001, xxi).

WHAT ROLES DOES THE LIBRARIAN PLAY IN BUILDING COMMUNITIES OF INQUIRY?

Librarians play important roles in building schoolwide communities of inquiry because they maintain a whole-school perspective, they teach inquiry skills to all students and across the curriculum, and they provide in-depth resources and a safe, nurturing environment open to all learners in the school. If librarians want to support in-depth inquiry learning, then they must assume four roles in the school: catalyst, connector, coach, and caregiver (Stripling 1993, unp.).

Catalyst

Librarians are in a position to act as change agents and provoke and support changes across a school. Librarians have the opportunity to design instruction and co-teach with every teacher in the school. Both the librarian and the classroom teachers grow in expertise through the co-teaching experiences. Educational research has shown that teachers are able to change their practice and improve their pedagogical skills most dramatically when they have the opportunity to work with and observe other teachers.

Librarians also can provide whole-school oversight over the implementation of new curricula or instructional methodologies. For example, if the teachers in a school decide to implement inquiry across the curriculum, the librarians can support every teacher with professional resources, communicate successful strategies from one teacher or department to others wrestling with the same issues, and keep track of schoolwide implementation. In many schools, librarians facilitate the process of curriculum mapping, a necessary step in any process of curriculum change and an essential step in developing an inquiry curriculum that is a spiral of key ideas in each discipline area.

Librarians are often called upon to offer professional development opportunities to teachers on inquiry strategies and unit development, the effective use of resources and technology, and strategies to connect learning with the real world. Because such professional development originates within the building around specific, expressed teacher needs, it has the potential to change practice, especially if the professional development itself is inquiry-based. Librarians can also facilitate faculty study groups on inquiry, investigating together the issues and questions that arise as teachers make the difficult transition to inquiry-based teaching.

Librarians' effect on students across the school can be equally as dramatic. The librarian's role as a catalyst is to provide a consistent vision of inquiry-based learning. The articulation of inquiry skills and the integration of inquiry into all content areas are important ways that librarians change the learning patterns across the school.

Finally, the librarian fulfills the role as a catalyst for change to an inquiry-based environment by serving on the school leadership team. Any schools attempting to integrate inquiry into curriculum and instruction encounter resistance from those who do not want to change; complex issues about scheduling, instructional budget priorities, selection of teaching materials, infusion of technology, professional development, and many other areas; questions about control, authority, and collaboration among teachers and administrators; and the messy recursiveness of any inquiry process. Because of intimate knowledge of the issues involved in inquiry, the librarian can facilitate the leadership team's decision-making process.

Connector

The librarian also has the role of connector in the school. Librarians connect to individual teachers by collaborating on instructional units. The connections are extended when librarians connect one teacher with another for interdisciplinary or collaborative teaching. For example, librarians can connect fifth-grade classes researching insects to first-grade classes by helping the fifth graders write information books to share with their first-grade study buddies. In secondary schools where teachers generally are isolated into subject-specific realms, librarians can serve as brokers to help teachers form instructional links across the curriculum.

Because inquiry is enhanced by conversation and sharing, the librarian uses cooperative learning techniques to connect students with one another around intriguing inquiry investigations. The library serves as an Information Commons with a focus on students learning together. As a connector, the librarian throws out the old-fashioned paradigm of the library as a place limited to silent, individual study.

The librarian also connects students and teachers to the world of ideas through

resources and electronic access. Inquiry demands increased access to multiple resources and diverse perspectives. To fulfill the pressure for increased resources, especially in times of tight budgets, librarians must change selection criteria to emphasize in-depth information that intrigues the learners (e.g., a whole book on hairstyles throughout history), primary sources, a balance in points of view, and appropriateness for the curriculum. The librarian also connects students and teachers to the best Internet sites and community resources (e.g., speakers, other libraries, museum collections, historical society archives).

Because inquiry in each classroom could easily overwhelm the capacity of the library and librarian, schools need to reconceptualize access to library resources. Instead of trying to schedule classes into the library for every inquiry experience, librarians may need to create unit boxes of relevant materials to be checked out to teachers, develop a plan of revolving classroom collections to surround students in the classroom with multiple library resources on their units of study, provide webliographies and library Web-based pathfinders that students can access from computer labs and classrooms, develop access to digitized resources, and enlist parent volunteers to coordinate access to community resources.

Coach

To create communities of inquiry, librarians must become coaches who facilitate the development of independent and responsible learners. Although the librarian needs to teach minilessons to help students develop new skills, often the librarian needs to coach students in their investigations. Two useful techniques for librarians as coaches are think-alouds and modeling. In think-alouds, the librarian who is helping a student talks through his or her mental processes as he or she makes decisions (e.g., "I know my question deals with the role of women during the Revolutionary War. I already have some overview information from the encyclopedia, but I might find some more specific information in American history books or in books about women's role in society. What key words should I use?"). In modeling, the librarian provides an example that serves as a guide for student work (e.g., sample two-column learning-log notes on Al Capone when students are getting ready to take notes on their 1920s topics).

The coach role works only when the librarian and classroom teacher assess student progress continuously. Because students are not moving in lockstep through the inquiry process, the librarian-coach must assess what students need on a daily basis. A number of techniques provide that information, including daily summaries of progress, end-of-class questioning, and research journals. For the librarian to succeed in this formative assessment, each student must respond to daily prompts, and communication between the librarian and classroom teacher must be clear and continuous.

Caregiver

The caregiver role is personally rewarding to both librarians and students. Research has shown increased student achievement in personalized environments. Inquiry lends itself to a more personalized approach to learning because each student is pursuing his or her own questions and seeking information that is meaningful to him or her. The librarian must be sure that the library collection responds to individual needs by including materials in different languages, at various reading levels, at various levels of complexity in the content, and with multiple perspectives. Perhaps more importantly, the librarian must offer "just-in-time" instruction and support tailored to individuals' needs.

The librarian as caregiver also makes the library a safe place for the pursuit and interchange of ideas. Establishing book discussion groups, inviting students to help select new books to order, celebrating students' work and final products as well as their creative expressions, and providing programs around students' interests will all help students become excited about learning and motivate them to make the library their own.

WHY ARE COMMUNITIES OF INQUIRY SO IMPORTANT?

Communities of inquiry are created when teachers and students build a shared purpose for learning, when they embrace a diversity of perspectives and engage in the process of developing new understandings, when they share responsibility for supporting and challenging each other, and when they connect their learning experiences in school with the outside world and their futures. Librarians help establish schoolwide communities of inquiry by becoming catalysts, connectors, coaches, and caregivers. The power of such schoolwide focus cannot be underestimated. Communities of inquiry have the potential to change the national conversation from "All students *can* learn" to "All students *will* learn."

REFERENCES

Allington, Richard L. 2002. "You Can't Learn Much from Books You Can't Read." *Educational Leadership* 60, no. 3 (November): 16–19.

Atwell, Nancie. 1987. *In the Middle: Writing, Reading, and Learning with Adolescents.* Portsmouth, NH: Heinemann.

Barell, John. 1995. *Teaching for Thoughtfulness: Classroom Strategies to Enhance Intellectual Development.* 2nd ed. White Plains, NY: Longman.

Barton, Mary Lee, Clare Heidema, and Deborah Jordan. 2002. "Teaching Reading in Mathematics and Science." *Educational Leadership* 60, no. 3 (November): 24–28.

Beach, Richard, and Jamie Myers. 2001. *Inquiry-Based English Instruction.* New York: Teachers College.

Benjamin, Amy. 1999. *Writing in the Content Areas.* Larchmont, NY: Eye on Education.

Billmeyer, Rachel, and Mary Lee Barton. 1998. *Teaching Reading in the Content Areas: If Not Me, Then Who?* 2nd ed. Aurora, CO: McREL.

Brackett, Josh. 2002. *Content-Area Reading Strategies: Mathematics.* Portland, ME: J. Weston Walch.

Brandt, Ron. 1993. "On Teaching for Understanding: A Conversation with Howard Gardner." *Educational Leadership* 50, no. 7 (April). URL: http://www.ascd.org/reading room/edlead/9304/brandt.html (accessed October 16, 2002).

Bransford, J. D., A. L. Brown, and R. Cocking, eds. 1999. *How People Learn: Brain, Mind, Experience, and School.* Washington, DC: National Academy Press.

Brooks, Jacqueline Grennon, and Martin G. Brooks. 1993. *In Search of Understanding: The Case for Constructivist Classrooms.* Alexandria, VA: ASCD.

Brown, Rexford G. 1991. *Schools of Thought.* San Francisco: Jossey-Bass.

Cleveland, Margaret. 2002. *Content-Area Reading Strategies: Language Arts.* Portland, ME: J. Weston Walch.

Clinton, Patrick. 2002. "The Crisis You Don't Know About." *Book* (September/October): L4–L9.

Cushman, Kathleen. 1999. "The Cycle of Inquiry and Action: Essential Learning Communities." *Horace* 5, no. 17 (April). URL: http://www.essentialschools.org/cs/resources/view/ces_res/74 (accessed October 4, 2002).

Dewey, John. 1938. *Experience and Education.* New York: Simon & Schuster.

Fisher, Douglas, Nancy Frey, and Douglas Williams. 2002. "Seven Literacy Strategies That Work." *Educational Leadership* 60, no. 3 (November): 70–73.

Fogarty, Robin. 1999. "Architects of the Intellect." *Educational Leadership* 57, no. 3 (November): 76–78.

French, Lisa. 2002. *Content-Area Reading Strategies: Social Studies.* Portland, ME: J. Weston Walch.

Gardner, Howard. 2000. *The Disciplined Mind: Beyond Facts and Standardized Tests, the K–12 Education That Every Child Deserves.* New York: Penguin.

Glatthorn, Allan A. 1998. *Performance Assessment and Standards-Based Curricula: The Achievement Cycle.* Larchmont, NY: Eye on Education.

Glatthorn, Allan A., ed. 1995. *Content of the Curriculum.* 2nd ed. Alexandria, VA: ASCD.

Graves, Michael F., and Bonnie B. Graves. 1994. *Scaffolding Reading Experiences.* Norwood, MA: Christopher-Gordon.

Hamilton, Gina. 2002. *Content-Area Reading Strategies: Science.* Portland, ME: J. Weston Walch.

Harvey, Stephanie. 1998. *Nonfiction Matters: Reading, Writing, and Research in Grades 3–8.* Portland, ME: Stenhouse.

Harvey, Stephanie, and Anne Goudvis. 2000. *Strategies That Work.* Portland, ME: Stenhouse.

Hirsch, E. D. 2001. "Seeking Breadth and Depth in the Curriculum." *Educational Leadership* 59, no. 2 (October): 22–25.

Hyerle, David. 2000. *A Field Guide to Using Visual Tools.* Alexandria, VA: ASCD.

Hyerle, David. 1996. *Visual Tools for Constructing Knowledge.* Alexandria, VA: ASCD.

Ivey, Gay, and Karen Broaddus. 2000. "Tailoring the Fit: Reading Instruction and Middle School Readers." *The Reading Teacher* 54, no. 1 (September): 68–78.

Jacobs, Heidi Hayes, ed. 1989. *Interdisciplinary Curriculum: Design and Implementation.* Alexandria, VA: ASCD.

Jacobs, Vicki A. 2002. "Reading, Writing, and Understanding." *Educational Leadership* 60, no. 3 (November): 58–61.

Jacobs, Vicki A. 2000. "Using Reading to Learn: The Matter of Understanding." *Perpectives: The International Dyslexia Association* 26, no. 4: 38–40.

Lacampagne, Carole B. 1993. *State of the Art: Transforming Ideas for Teaching and Learning Mathematics*. Washington, DC: Office of Research, U.S. Department of Education.

Lile, Stephanie. 2001. "Inquiry in Action." *Columbia* 15, no. 1 (Spring). URL: http://www.wshs.org/columbia/0101-a1.htm (accessed October 16, 2002).

Love, Nancy. 2002. *Using Data/Getting Results: A Practical Guide for School Improvement in Mathematics and Science*. Norwood, MA: Christopher-Gordon.

Marzano, Robert J. 1992. *A Different Kind of Classroom: Teaching with the Dimensions of Learning*. Alexandria, VA: ASCD.

Marzano, Robert J., and Daisy E. Arredondo. 1986. *Tactics for Thinking Teacher's Manual*. Aurora, CO: Mid-continent Regional Educational Laboratory.

Marzano, Robert J., and John S. Kendall. 1996. *Designing Standards-Based Districts, Schools, and Classrooms*. Alexandria, VA: ASCD.

Marzano, Robert J., and John S. Kendall (with B. B. Gaddy). 1999. *Essential Knowledge: The Debate over What American Students Should Know*. Aurora, CO: Mid-continent Regional Educational Laboratory.

Marzano, Robert J., Debra J. Pickering, and Jane E. Pollock. 2001. *Classroom Instruction That Works*. Alexandria, VA: ASCD.

McClymer, John. "An Inquiry Approach to Teaching U.S. History." URL: http://www2.h-net.msu.edu/teaching/essays/mcclymer.html (accessed October 16, 2002).

McLaughlin, Maureen, and Mary Ellen Vogt, eds. 2002. *Creativity and Innovation in Content-Area Teaching*. Norwood, MA: Christopher-Gordon.

McREL. 2001. *Standards in Classroom Practice*. Aurora, CO: Mid-continent Research for Education and Learning. URL: http://www.mcrel.org/PDF/Synthesis/5012RR_RSStandardsClassroomPractice.pdf (accessed May 15, 2003).

Mills, Heidi, and Amy Donnelly. 2001. *From the Ground Up: Creating a Culture of Inquiry*. Portsmouth, NH: Heinemann.

National Research Council. 2000. *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*. Washington, DC: National Academy Press.

Nelson, George D. 2001. "Choosing Content That's Worth Knowing." *Educational Leadership* 59, no. 2 (October): 12–16.

Newmann, Fred M., Walter G. Secada, and Gary G. Wehlage. 1995. *A Guide to Authentic Instruction and Assessment: Vision, Standards and Scoring*. Madison: Wisconsin Center for Education Research.

Pappas, Marjorie L., and Ann E. Tepe. 2002. *Pathways to Knowledge® and Inquiry Learning*. Greenwood Village, CO: Libraries Unlimited.

Perkins, David. 1999. "The Many Faces of Constructivism." *Educational Leadership* 57, no. 3 (November): 6–11.

Perkins, David. 1993. "Teaching for Understanding." *American Educator: The Professional Journal of the American Federation of Teachers* 17, no. 3 (Fall): 8, 28–35. URL: http://www.exploratorium.edu/ifi/resources/workshops/teachingforunderstanding.html (accessed October 16, 2002).

Santa, Carol Minnick, and Donna E. Alvermann, eds. 1991. *Science Learning: Processes and Applications*. Newark, DE: International Reading Association.

Schoenbach, Ruth, Cynthia Greenleaf, Christine Cziko, and Lori Hurwitz. 1999. *Reading for Understanding: A Guide to Improving Reading in Middle and High School Classrooms*. San Francisco: Jossey-Bass.

Senge, Peter et al. 2000. *Schools That Learn*. New York: Doubleday.

Sivertsen, Mary Lewis. 1993. *State of the Art: Transforming Ideas for Teaching and Learning Science*. Washington, DC: Office of Research, U S. Department of Education.

Stripling, Barbara K. 1995. "Learning-Centered Libraries: Implications from Research." *School Library Media Quarterly* 23, no. 3 (Spring): 163–170.

Stripling, Barbara K. 1993. "How to Make Educational Changes Work for Your Students" (brochure). Chicago: American Library Association.

Sweet, Anne P. 1993. *State of the Art: Transforming Ideas for Teaching and Learning to Read*. Washington, DC: Office of Research, U.S. Department of Education.

Taylor, Barbara M., Michael F. Graves, and Paul Van Den Broek, eds. 2000. *Reading for Meaning: Fostering Comprehension in the Middle Grades*. New York: Teachers College Press.

Thier, Marlene, with Bennett Daviss. 2002. *The New Science Literacy: Using Language to Help Students Learn Science*. Portsmouth, NH: Heinemann.

Topping, Donna, and Roberta McManus. 2002. *Real Reading, Real Writing: Content-Area Strategies*. Portsmouth, NH: Heinemann.

Vacca, Richard T. 2002. "From Efficient Decoders to Strategic Readers." *Educational Leadership* 60, no. 3 (November): 6–11.

Watson, Bruce, and Richard Kopnicek. 1990. "Teaching for Conceptual Change: Confronting Children's Experience." *Phi Delta Kappan* (May): 680–684. URL: http://www.exploratorium.edu/ifi/resources/workshops/teachingforconcept.html (accessed October 16, 2002).

Wells, Gordon. "Dialogic Inquiry in Education: Building on the Legacy of Vygotsky." URL: http://www.oise.utoronto.ca/~gwells/NCTE.html (accessed October 4, 2002).

Wiggins, Grant, and Jay McTighe. 1998. *Understanding by Design*. Alexandria, VA: ASCD.

Zemelman, Steven, Harvey Daniels, and Arthur Hyde. 1998. *Best Practice: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.