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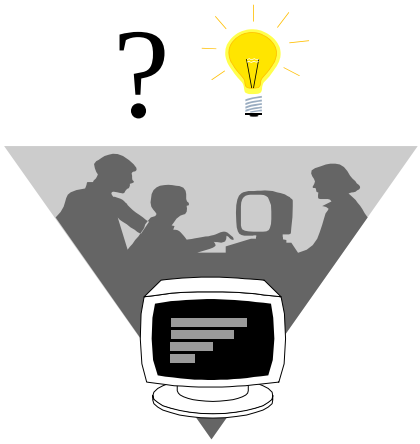
Scientific Research Summary



Why ProQuest Library Learning Resources with Professional Development in the Unique Mini-Research Process . . .

Increase Student Learning & Achievement

June 2006

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A Summary of Scientific-Based Research (SBR)
Supporting the Use of Inquiry-Based Teaching/Learning Strategies

The following collection of scientific-based research findings is intended to provide curriculum leaders in public and private K-12 schools with the motivation and evidence to integrate more inquiry-based teaching strategies into the curriculum. These strategies require student to seek and use relevant and authoritative information to solve problems and to make informed decisions based on "reasoned opinion."

These mini-research activities encourage the use of reading, writing, and critical thinking (state standards and assessment skills) as the tools to explore relevant topics and issues that contribute to better understanding of academic content. The essential higher-order thinking skills developed will serve students well during school, in life, and in future careers.

<u>These activities are ONLY effective in increasing student achievement when . . .</u>

1. a variety of learning resources, both print and electronic, are available to students and teachers
2. teachers know how to structure these activities to engage student higher-order thinking skills (HOTS)
3. learning resources are customized to the reading needs and interests of the learners

The benefits of inquiry-based learning are many including the lifelong ability of learning how to learn, information literacy, technology literacy, and deeper understanding of academic content. But this summary will focus **only** on the benefits that are currently recognized as **essential skills** and are tested on **state assessments**:

1. Reading, particularly ***inferential reading***
2. Expository and persuasive writing
3. Critical thinking and problem solving

Each of the learning-related categories and the scientific research citations listed in this summary are applicable to the **unique content and features of eLibrary** when combined with **teacher training** in the **ProQuest mini-research process**. Working together, this combination of technology, learning resources, and proven pedagogy provides the tools for teachers to customize learning activities by state standards, and student interest and reading level. These are some of the strategies that scientific-based research has shown **increases student achievement**, especially in the three areas listed above.

ProQuest Learning Resources, Mini-Research and Student Achievement

Scientific research has identified many learning strategies and activities that help to increase student achievement. One of these is **student research on engaging current issues**. Through technology and the Internet, it is possible for this type of successful traditional learning activity to occur **more frequently** than in the past through "mini-research," therefore the learning benefits are multiplied. These benefits include the essential skills of **inferential reading, expository and persuasive writing, and critical thinking**. These skills are the heart of **state standards** and the accompanying **state assessments** which measure student achievement. eLibrary's **new training model** helps provide teachers with the strategies, models, content, and tools that make ProQuest mini-research activities generate increased student achievement in essential skills and academic content too.

Scientific-Based Research (SBR) Support for Student Research Activities Students Learn Better When They	Teacher + Textbook Learning	**Teacher + Textbook+ eLibrary**
Have daily access to visual, interactive, websites and multimedia content as well as verbal information -- *most learners have a visual learning styles* **(5)**	No	*Yes*
Are involved in solving problems relevant to their community and world -- *permanent learning only occurs when information is socially relevant* **(1)**	?	*Yes*
Have daily access to current information in the topic of study -- *learning in context of the learner's world increases motivation and permanent memory* **(1)**	No	*Yes*
Have to defend their opinions on relevant issues with facts -- *information can be constructed into knowledge through engaging inquiry-based activities* **(4,2,6)**	?	*Yes*
Integrate reading with writing in an activity that focuses on questions of how, why, why not, and what if. -- *higher-order thinking results in greater learning* **(2,3)**	?	*Yes*
Integrate reading and writing in the same activity -- *both reading and writing are learned more effectively when taught together rather than separately* **(2,7)**	?	*Yes*
Present the products of their mini-research and ideas to peers and/or others -- *peer review provides the motivation that is essential to learning* **(1,2)**	?	*Yes*
Collaborate with others to solve a problem or defend an opinion -- *collaboration and communication provides essential feedback to test ideas and concepts* **(3,6)**	?	*Yes*
Investigate topics in-depth – *in-depth learning provides greater retention of ideas; surface learning of facts is temporary* **(1,4)**	?	*Yes*
Learn by problem solving with a variety of relevant information--*application of facts and concepts through activity results in increased learning* **(6)**	?	*Yes*
Can easily explore other topics related to the current lesson or theme -- *the brain processes information through patterns and associations* **(1,7)**	No	*Yes*
Can learn anytime and anywhere -- *learning is more efficient when students are ready to learn* **(7)**	No	*Yes*
Integrate time-saving technology tools into their learning process – *time must be conserved for higher-order thinking by minimizing lower-order tasks* **(6,7)**	No	*Yes*
Access customized learning resources at home and at school -- *parent support and always-available and appropriate learning resources increase achievement* **(1,7)**	No	*Yes*

Scientific-based research support is summarized in **parentheses**. Each summary contains the number of the section of this guide (see Table of Contents) where supporting information and citations can be found.

The studies of **library power** from **Colorado,** Pennsylvania, and Oregon are summarized starting on page 13 These formal studies prove that proactive librarians and quality library collections (print and digital) do raise student academic achievement.

1. Brain Research and Implications for Teaching and Learning

ProQuest learning resources provide the content that teachers can use to make learning meaningful. Because content is always current, it connects more easily with a student's world than a textbook. The skillful use of this content empowers teachers to create the mini-research activities that motivate students to understand the historic world by making connections to their current world.

The brain searches for meaning through patterning. It will naturally attempt to **make connections within the brain with what is familiar**. The brain attempts to self-organize information into categories or mental models. Educators can help students to effectively construct these models by helping students to **see and understand connections**. Perkins (1993) suggests the use of **generative topics** to help students establish these connections. Generative topics are those topics that are central to a subject matter but encourage a **great deal of exploration in and out of the subject matter**. This type of exploration helps students to see the larger picture and to make connections. *(Caine & Caine, 1999 & Funderstanding, Neuroscience, 1998).*

Personal meaning: The key to memory--The bodybrain is designed to make meaning out of the chaos that is the thousands of bits of sensory data humans process each minute. Essentially the brain asks, "Does this make sense?" and "Do I care?" **New input must carry emotional value and useful content** or the brain **efficiently ignores it.** For students to construct **personal meaning from the school curriculum, they must see how it connects to their lives.**

The brain **seeks and perceives patterns**, **creates meanings, integrates sensory experience, and makes connections.** Therefore, modern teaching should **involve active learning**, a focus on constructing meaning, and authentic assessment. *(Robert Sylvester, author of A Celebration of Neurons: An Educator's Guide to the Human Brain)*

Research indicates that learners benefit from opportunities to **articulate their ideas to others, challenge each others' ideas, and, in doing so, reconstruct their ideas** *(Rosebery et al., 1992).*

To demonstrate understanding, students must be able to carry out thought-demanding tasks relating to the topics. Perkins *(1992 & 1993)* calls these "understanding performances". Like Perkins, brain-based education calls for teachers to teach for meaning and understanding. Students are expected to **make active use of the knowledge and to demonstrate that they understand the information** through its active use.

Learner-centered environments attempt to help **students make connections between their previous knowledge and their current academic tasks. Parents are especially good at helping their children make connections**. (*Research Findings from How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academy Press).*

2. Writing As an Essential Activity to Develop Critical Thinking and Language Arts

ProQuest mini-research activities provide ongoing opportunities for developing student self-expression using expository and persuasive writing skills. These forms of writing are used in problem solving and the construction of "reasoned opinions using researched facts and expert opinion combined with higher-order thinking skills (HOTS). These forms of writing are essential for future success in higher education and careers.

The National Commission on Writing in America's Schools and Colleges this past April called for "**a writing revolution**" in schools. The 20-member panel of scholars and school administrators convened by the College Board, sponsor of the SAT, called for schools to **double the time spent on writing**. (*Education Week; "Panel Calls for Writing Revolution in Schools," April 30, 2003.*)

1. NCW – "Writing is essential to educational and career success"
2. NCW – "Writing allows students to "connect the dots" in their knowledge and is central to self-expression"
3. NCW – "Writing is how we teach students the complex skills of analysis, synthesis, and problem solving"
4. NCW – "Writing must become an important focus beginning with elementary school
5. NCW – "Assessment with only multiple-choice tests is not adequate"

The College Board's decision to include writing in the SAT starting in 2005 is based on research (*The College Board*) over decades and indicates that

- the number of writing activities assigned in K-12 classroom has diminished and been replaced by increasing use of multiple choice assessments which require less teacher time and effort to grade.
- narrative, expository, and persuasive writing require the use of higher-order thinking skills (HOTS). HOTS is essential for permanent learning vs. rote learning that is primarily temporary.
- strong writing skills are a reliable and essential predictor of college success

3. Higher-Order Thinking Skills Research Findings

ProQuest mini-research activities and curriculum resources are based on Bloom's Taxonomy of cognitive learning. The highest level of thinking is the ability to evaluate information and ideas for purposes of making decisions and solving problems. Developing these skills is inherent in mini-research and eventually leads to habits of mind that are necessary for success in higher education, life, and careers.

Critical thinking skills are used to **evaluate the worth of ideas, opinions, or evidence** advanced by others in order to make **better informed judgments and decisions**. Such skills especially help students detect bias in everyday propaganda faced by the public and can be understood by all levels of children, **including students with special needs.** (*Beyer, 1987; Ennis, 1989; Glaser, 1985*)

The most common explanations for **why schools do not currently teach higher-order thinking** focus on teacher, curricular, and institutional factors. The approach is, to use a medical analogy, similar to affirming that "**the patient failed to respond**," rather than "I **misdiagnosed** or I **misprescribed**." The current conclusion is that the barriers to the teaching of higher-order thinking are in the organizational context of schools, not in the assumptions on which the instructional model is based. has identified **six such barriers to the teaching of higher-order thinking skills:** (*Onosko, 1991*)

1. Teaching as knowledge transmission. The dominant agenda in classrooms is student acquisition of knowledge, and teachers consistently transmit that knowledge to students in ways that **fail to challenge students to think**.
2. Broad, superficial coverage of content. Teachers tend to cover superficially a broad range of information and ideas with students. The emphasis on coverage **leaves little time for activities focusing on the development of thoughtfulness**.
3. Teachers' low expectations of students. Students are perceived as incapable of succeeding or unwilling to attempt higher-order thinking tasks.
4. Large numbers of students in a class. This phenomenon makes the management of a classroom environment characterized by the free and **open exchange of ideas a difficult one.**
5. Lack of teacher planning time. It is easier to construct lessons that **require rote memorization** than it is to construct lessons that **challenge students' thinking**. It is also easier to **grade** rote learning assignments than to **evaluate students' written expressions of thought**.
6. A culture of teacher isolation. Teacher isolation does not encourage the **sharing of information** on creative and innovative instructional practices.

Competency (Lowest to Highest)	**Bloom's Taxonomy of the Cognitive Domain -- Thinking Skills Demonstrated** *(B. S. Bloom, 1954)*
Knowledge (Low) (***Most instruction, testing, and evaluation of student learning is at this level because it is the easiest to measure***)	• observation and recall of information • knowledge of dates, events, places • knowledge of major ideas • mastery of subject matter much of it by rote • *Question Cues:* list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
Comprehension	• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences • *Question Cues:* summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
Application	• use information • use methods, concepts, theories in new situations • solve simple problems using required skills or knowledge • *Questions Cues:* apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
Analysis ***PQ Mini-research strategies and performance-based learning***	• seeing patterns • organization of parts • recognition of hidden meanings • *Question Cues:* analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer
Synthesis ***PQ Mini-research strategies and performance-based learning***	• use old ideas to create new ones • generalize from given facts • relate knowledge from several areas • predict, draw conclusions • *Question Cues:* combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite
Evaluation ***PQ Mini-research strategies and performance-based learning***	• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • *Question Cues:* assess, decide, rank, grade, measure, recommend, persuade, select, judge, discriminate, support, conclude, compare

4. Inquiry-Based Learning and Problem Solving Research Findings

*Inquiry-based learning is the heart of well-constructed student **mini-research activities**. These activities must be based on asking questions that require critical thinking to construct **reasoned opinions**. Reading, writing, and reporting the conclusions of this thinking, helps students build essential lifetime skills.*

Effective inquiry is more than just asking questions. **A complex process is involved when individuals attempt to convert information and data into useful knowledge.** Useful application of inquiry learning involves several factors:

- context for questions,
- framework for questions,
- focus for questions, and different **levels** of questions.

Well-designed inquiry learning produces **knowledge formation that can be widely applied and transferred.**

Through the process of inquiry, individuals construct much of their understanding of the natural and human-designed worlds. **Inquiry implies a "need or want to know" premise.** Inquiry is not so much seeking the right answer **-- because often there is none -- but rather seeking appropriate resolutions to questions and issues.**

Inquiry is an **essential for education, because the fund of knowledge is constantly increasing.** Trying to transmit "what we know," even if it were possible, is counterproductive in the long run. This is why **schools must change** from a focus on "*what we know*" to an emphasis on "***how we come to know***."

Just as students should not be focused only on content as the ultimate outcome of learning, **neither should they be asking questions and searching for answers about minutiae**. Inquiry in education should be about a **greater understanding of the world in which they live, learn, communicate, and work.** (*A Context for Inquiry* -- http://www.nap.edu/openbook/0309065577/html/index.html; *National Research Council*)

All of these processes also require students to **analyze two or more elements in terms of their similarities and differences on one or more characteristics, a mental operation that researchers have concluded is basic to human thought** *(see Markman & Gentner, 1993, 1993; Medin, Goldstone, & Markman, 1995; Gentner & Markman, 1994).*

- Ask Questions that Require Students to **Make Inferences** About Content**.**
- Present Students with Questions that **Require Them to Analyze What They Are Studying in Complex Ways.**
- **Constructing Support or proof for an assertion.**
- **Analyzing Perspectives:** What is the reasoning behind his or her perspective?
- What is an **alternative perspective,** and what is the **reasoning behind it?**

We are fighting a long school history of topical research. For decades students have been sent to the library to "**find out about**" some topic. This tradition has led to **information gathering but little analysis or thought.**

Essential questions reside at the top of Bloom's Taxonomy (*Bloom, 1954*). They require students to EVALUATE (make a thoughtful choice between options, with the choice based upon clearly stated criteria), to SYNTHESIZE (invent a new or different version) or to ANALYZE (develop a thorough and complex understanding through skillful questioning). (*Framing Essential Questions – (J. McKenzie; www.fno.org, A Questioning Toolkit; Nov-Dec 1997)*

- Essential questions spark our curiosity and sense of wonder. They derive from some deep wish to understand some thing which matters to us.
- Answers to essential questions **cannot be found**. **They must be invented**. Students must construct their own answers and **make their own meaning from the information they have gathered**. They create insight.
- Essential questions engage students in the kinds of **real life applied problem-solving suggested by nearly every new curriculum report or outline curriculum standards** such as the NCTM and the Science Standards.
- Essential questions usually lend themselves well to multidisciplinary investigations, requiring that students **apply the skills** and perspectives of math and language arts while wrestling **with content** from social studies or science.

Embedded within the **inquiry-based process** are numerous process and thinking skills that make this type of learning a rich and meaningful experience for students. Students may engage in this process as individual learners, or in cooperative teams.

Many teachers rely to heavily on "**What is..**" questions such as "What is cancer." Asking a student to answer such in a research project is licensing the student to move information from point A to point B without concern for integrating discrete information pieces into new knowledge or fresh insights. Effectively, in this day of digital "cutting and pasting," **asking a "What is.." question is a license to plagiarize.**

A much better question requiring the development of an action plan regarding the cancer topic cited above might be: "What plan can I develop for reducing the chance that I will contract cancer in my lifetime?" In this scenario, a student must research the question to develop a list of strategies; the teacher then may require the student to select the **top three strategies from the list and then justify why those were chosen. *In this question, active knowledge construction is required.*** (*http://www.biopoint.com/inquiry/*)

. . **knowledge of a large set of disconnected facts is not sufficient**. To develop competence in an area of inquiry, students must have opportunities to **learn with understanding.** Deep understanding of subject matter **transforms factual information into usable knowledge.** *(How People Learn; M. Suzanne Donovan, et. al., editors; Committee on Learning Research and Educational Practice; National Research Council)*

5. Multiple Learning Styles--the Need for Visuals & Variety in Learning Activities

*eLibrary provides millions of photos, maps, interactive multimedia, film clips,, and websites for students **and** teachers to use. Visual learning and teaching is more effective than verbal learning. eLibrary mini-research activities engage students to learn more effectively than with lecture-discussion pedagogy. These activities provide opportunities for students to use a different set of learning style preferences, personalize learning, and have their ideas and thinking measured by assessments other than multiple choice testing on "who, what, when, and where".*

"Can we see learning preferences through brain imaging?" The answer is definitely yes. We see very direct evidence that a sizable percentage of students **do** have an auditory or visual sensory preference. The majority of the adolescents who show a sensory preference have **a visual sensory preference.** (*http://www.brains.org/update.htm*)

Learning is mediated by the social environment in which learners interact with others. Research indicates that learners benefit from opportunities to **articulate their ideas to others, challenge each others' ideas, and, in doing so, reconstruct their own ideas**. (*Rosebery et al., 1992*).

Problem solving is best learned in groups. Not only do groups solve problems quicker than individuals, but when members of the group have to solve subsequent problems alone, they do better than those individuals without the group experience. (*Barron. J. of Ed Psych. 2000 vol. 92(2) 391-398*.)

Our children learn to read by putting words and letters together with pictures. Why is this so effective? **Pictures are concrete representations of reality**. Words are abstractions.

Research has demonstrated that children can successfully use **imagery strategies** in their learning. Many studies have shown the effectiveness of **teaching children concepts through pictures** and of generating visual images to accompany other verbal material to be learned. **As a result of using visuals**, comprehension of the information and recall of key ideas are facilitated. *(Higbee, K.L; 1979)*

Learning styles theory emphasizes the fact that **individuals perceive and process information in very different ways**. The learning styles theory implies that how much individuals learn has more to do with **whether the educational experience is geared toward their particular style of learning than whether or not they are "smart."** In fact, educators should not ask, "Is this student smart?" but rather "How is this student smart?"

Traditional schooling tends to favor abstract perceiving and reflective processing. Other kinds of learning aren't rewarded and reflected in curriculum, instruction, and assessment nearly as much. *(http://www.funderstanding.com/theories.cfm)*

6. Teacher Effectiveness Research Findings and Implications

The new eLibrary training model provides teacher training in the entire mini-research process to support them in their transition from textbook "who, what, where, and when" learning and testing to inquiry-based and in-depth learning. Teachers will learn how to use the models, eLibrary content and teacher tools through ongoing and hands-on training. This will empower them to create new learning activities that research has shown increases student motivation and achievement.

Teachers encourage student inquiry by asking thoughtful, **open-ended questions** and encouraging students to ask questions of each other. The questions are designed to challenge students to look beyond the apparent, **delve into issues deeply and broadly**, and **form their own understandings**. **Often, there is no one "right" interpretation**, even though some analyses are more sophisticated and useful than others. (*Educational Leadership -- Volume **50** Number **7** April 1993)*

Vision of Engaged Learning in the Classroom; *Designing Learning and Technology for Educational Reform, by Beau Fly Jones, Gilbert Valdez, Jeri Nowakowski, and Claudette Rasmussen; NCREL, 1994).*

- Challenging. Unlike tasks usually offered in schools, challenging tasks are **typically complex and required sustained amounts of time**. Such tasks also require students to stretch their thinking and social skills in order to be successful.
- Authentic. Authentic tasks correspond to tasks in the home and workplace. They are closely related to **real-world problems and projects**, build on life experiences, require in-depth work, and benefit from frequent collaboration.
- Integrative/interdisciplinary. Challenging and authentic tasks often require integrated instruction, which blends disciplines into **thematic or problem-based pursuits**, and instruction that incorporates problem-based learning and **curriculum by project.**

Learning Method	Practical Application	% Learned
Teach Others	Presenting new knowledge to peers/others	90%
Learn By Doing	Problem solving through inquiry	75%
Discussion Groups	Learning by having ideas challenged	50%
Demonstration	Integrating real processes and examples	30%
Audio Visual	Show me and I remember—images aid learning	20%
Lecture	Tell me and I forget—worst methodology	10%
(Source: Andersen Consulting -- How People Learn)		

Eisenhower Study of Professional Development *(Designing Effective Professional Development: Lessons from the Eisenhower Program, by M. Garet, et. al., 1999, Washington, DC: U.S. Department of Education)*

Professional development focused on specific, **higher-order teaching strategies increases teachers' use of those strategies in the classroom**. This effect is even stronger when the professional development activity is a **reform type** (e.g., teacher network or study group) **rather than a traditional workshop or conference**; provides opportunities for active learning; is coherent or consistent with teachers' goals and other activities; and involves the participation of teachers from the same subject, grade, or school.

On the basis of data from our national sample of teachers, we concluded that **six key** features of professional development are effective in improving teaching practice.

Three are structural features, or characteristics of the structure of the activity:

- the organization of the activity—whether it is a **reform type,** such as a study group or teacher network, in contrast to a traditional workshop or conference;
- the duration of the activity, including the total number of contact hours and **the span of time over which it extends**; and
- the extent to which the activity has **collective participation** of groups of teachers from the same **school, department, or grade**.

The remaining three features are core features, or characteristics of the substance of the activity:

- the degree to which the activity has **active learning** opportunities for teachers,
- the extent to which the activity has a **content focus** and
- the degree to which the activity promotes **coherence** in teachers' professional development by incorporating experiences that are consistent with teachers' goals and aligned with **state standards and assessments**.

7. Technology Integration and Learning Research Findings

"Second-generation" thinking in educational technology does not see computers as magical, but it does make the mistake of focusing on automation as their fundamental purpose. It envisions computers as empowering "**teaching by telling**" and "**learning by listening.**" In this view, the **computer serves only as a fire hose that sprays information from the Internet into learners' minds.** Even without educational technology, **classrooms are already drowning in data**. Adding additional information, even with multimedia bells and whistles, is **likely to worsen** rather than improve educational settings.

Finally, the panel examined the use of computer technology to teach reading. Although not directly applicable to reading instruction, the use of ***hypertext-highlighted text that links to definitions or related text—may be a useful learning aid in the classroom.*** Moreover, the use of computers as ***word processors may also help students learn to read, as reading instruction is most effective when combined with writing instruction.*** *("National Reading Panel Reports Combination of Teaching Phonics, Word Sounds, Giving Feedback on Oral Reading Most Effective Way to Teach Reading," National Institute of Health News Alert, 4/13/00)*

Internet technology provides learning enhancements that enable all students to learn anytime, anywhere. While far from distinct and often integrated, these elements form a baseline for understanding e-learning: *(Education Anytime, Anywhere--How the Internet Changes Education http://www.trendsreport.net/education)*

- Access to Content**:** The Internet is making information available to learners as never before, driving the thirst for knowledge and **enabling real-time, real-world exploration from the desktop.**

- Individualized Learning**:** The Internet is providing the tools to **tailor content and instruction to the unique learning interests, needs and styles of students. Students can learn at their own pace -- from home, school, or work** -- and be directed through integrated diagnostic assessments to linked, supplemental enrichment or remedial curriculum.

Proof of the Power:
Quality Library Media Programs Affect Academic Achievement

by Keith Curry Lance • Director, Library Research Service • Colorado State Library and University of Denver

***MultiMedia Schools* • September 2001**

The evidence is mounting! By early 2000, researchers affiliated with the Library Research Service of the Colorado State Library and the University of Denver—myself included—had completed four statewide studies on the impact of school library media programs on the academic achievement of U.S. public school students:

- "Information Empowered: The School Librarian as an Agent of Academic Achievement in Alaska"
- "Measuring Up to Standards: The Impact of School Library Programs and Information Literacy in Pennsylvania Schools"
- "How School Librarians Help Kids Achieve Standards, The Second Colorado Study"
- "Good Schools Have School Librarians: Oregon School Librarians Collaborate to Improve Academic Achievement"

Philosophically, these studies are rooted in the "Information Power" model espoused by the American Association of School Librarians and the findings from 6 decades of research related to the impact of school library media programs on academic achievement.
The latest edition of *Information Power: Building Partnerships for Learning* (1998) identifies three roles for school library media specialists. In a learning and teaching role, library media specialists advance the instructional goals of the school. As providers of information access and delivery, they develop collections and services and facilitate their use. And, as program administrators, they serve as library media center managers as well as school-wide advocates and trainers for information literacy.

The Learning Teaching Role

Many early studies of this topic demonstrated the value of the mere presence of a professionally trained and credentialed library media specialist. Such correlations, however, beg the question of what the library media specialists are doing that makes a difference. In more recent studies, their contributions as creators of and collaborators in a learning community have been the focus. These studies indicate that students perform better academically where the library media specialist:

- is part of a planning and teaching team with the classroom.
- teaches information literacy.
- provides one-to-one tutoring for students in need.

The Information Access and Delivery Role

One of the most consistent strands of research on this topic is evidenced by studies that demonstrate the value of:

- quality collections of books and other materials selected to support the curriculum.
- state-of-the-art technology that is integrated into the learning/teaching processes.
- cooperation between school and other types of libraries, especially public libraries.

The Program Administration Role

A key role of the library media specialist, but one that has only been the subject of research for a decade, is program administration. In today's schools, library media specialists are not only managers of the library media center, but also advocates for information literacy with the principal, at faculty meetings, and in standards and curriculum committee meetings. In addition to being advocates, they are trainers who provide in-service programs for teachers on resource-based learning, integrating information literacy into the curriculum, and getting the most out of technology, as well as teaching students.

To be a successful advocate for information literacy, research shows that library media specialists must:

- have support staff who free them from the library media center to participate in important meetings.
- win and keep the support of the principal.
- manage networked technology.
- raise funds successfully.

THREE NEW SCHOOL LIBRARY SURVEYS

In each state study, we surveyed school library media programs at the building level on a variety of topics. The topics common to all three state studies were staffing levels, staff activities, collection size, usage statistics, and available technology.

The test instruments varied by state. Alaska utilized the California Achievement Tests (CAT), but both Pennsylvania and Colorado utilized their own state-designed, standards-based tests: the Pennsylvania System for Student Assessment (PSSA) and the Colorado Student Assessment Program (CSAP), respectively. On the basis of an analysis done as part of the original Colorado Study, reading scores were utilized in all three states. The earlier study found that reading scores correlate so highly with other types of test scores that the other types of scores are statistically redundant.

THE RESULTS

Successful Types of Library Media Predictors

While the results of the three studies varied somewhat, on the whole, the findings concerning what aspects of school library media programs are important were remarkably consistent.

Library Media Program Development: In all three states, the level of development of the library media program was a predictor of student performance, and data on staffing levels correlated with test scores. In both Pennsylvania and Colorado, additional data on collections and expenditures were predictive of reading scores. Where library media programs are better staffed, better stocked, and better funded, academic achievement tends to be higher.

Staff Activities: Levels of student performance were also related, in all three states, to the extent to which library media staff engaged in particular activities related to the teaching of information literacy and to the exercise of leadership, collaboration, and technology.

Library Media Center Usage: In both Alaska and Colorado, individual student visits to the library media center correlated with test scores. Notably, group library media center visits did not demonstrate such a correlation.

Technology: In Alaska, the availability of Internet-capable computers in the library media center was tied to test scores. In Pennsylvania and Colorado, where similar questions were asked about technology, achievement levels increased with the availability of networked computers, both in the library media center and elsewhere in the school, that provided access to catalogs, licensed databases, and the Internet.

Common Findings

All of the recent studies of the impact of school library media programs on academic achievement provide evidence to support several common findings:

- Professionally trained and credentialed school library media specialists do make a difference that affects student performance on achievement tests.
- For library media specialists to make this difference, the support of principals and teachers is essential.
- Library media specialists cannot perform their jobs effectively unless they have support staff who free them from routine tasks and enable them to participate in a variety of one-to-one and group meetings outside the library media center.
- Library media specialists have a twofold teaching role. They are teachers of students, facilitating the development of information-literacy skills necessary for success in all content areas, and they are in-service trainers of teachers, keeping abreast of the latest information resources and technology.
- Library media specialists also must embrace technology to be effective. They must ensure that school networks extend the availability of information resources beyond the walls of the library media center, throughout the building, and, in the best cases, into students' homes.

IMPLICATIONS

Recommended Actions by School Officials

The practical implications of these research findings are a clear and straightforward call to action:

- School library media programs should be funded sufficiently to employ both professional and support staff and to have both information resources in a variety of formats, and the technology necessary, to extend the library media program beyond the walls of the library media center.
- Library media specialists should be recognized and utilized by principals and teachers as professional colleagues in the teaching and learning enterprise. Where such recognition and the collaboration to which it leads do not exist, the library media specialist must exercise leadership in changing the environment.
- Technology is an essential part of a successful library media program. Information resources, including licensed databases, should be available throughout the school via networked computers in classrooms, labs, and offices.

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