Instructional Intervention for Information Use

Research Papers of the Sixth Treasure Mountain Research Retreat for School Library Media Programs

March 31-April 1, 1997
McMenamins Edgefield of Troutdale, Oregon

Edited by
Daniel Callison
Joy H. McGregor
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Introduction

What is the Treasure Mountain Research Retreat?

The Treasure Mountain Research Retreat is a gathering of the researchers and practitioners of the field of school library media programs. David V. Loertscher, its founder, invited two other scholars of the field, Drs. Blanche Woolls and Philip Turner to help organize the first Treasure Mountain Reseearch Retreat in 1989 in Loertscher's home town of Park City, Utah just prior to the meeting of the American Association of School Librarians in Salt Lake City Utah that year. The first retreat met at the Treasure Mountain Inn in Park City, a convention hotel facing Treasure Mountain - a 12,000 foot peak out of which a small group of miners dug a 400 foot hole to extract some $2 million worth of silver in the late 1900s starting a mini-mining boom 30 miles east of Salt Lake City. Hence the name Treasure Mountain.

The Treasure Mountain Research Retreat has met six times since its beginning in 1989. It has no officers, no organization - only a mailing list kept by whomever organizes it. Anyone can be on the mailing list of Treasrue Mountain by contacting its founder. As its founder, David Loertscher either extends invitations to or accepts volunteers to convene the next conference. A list of all the retreats is appended to this introduction. Treasure Mountain generally meets in conjunction with gatherings of the American Association of School Librarians (AASL) and thus has some ties to that organization, particularly its Research Committee, but has no official link. The Retreat is self-supporting but has been the recipients of two grants from Mandrain, Inc. and has received organizational support from the insitutions of Retreat organizers such as Libraries Unlimited,, and the School of Library and Informaiton Science at Indiana University. The proceedings of Treasure Mountain Research Retreats have been published by Hi Willow Research & Publishing or summarized in *School Library Media Annual*, a publication of Libraries Unlimited.

The dream of Treasure Mountain is to provide a platform for the researchers of the field of school library media programs to share their research aggendas, gather ideas for further research, and to interact with the practitioners of the field for whom the research is being aimed. It provides a unique opportunity for researchers to spread their wings - to announce and document progress - to test ideas. For practitioners, it provides an opportunity to think with researchers, to bring realism into research ideas, to question the direction of research, and to sense a direction for practice in their own school libraries. It continues to attract attendance based on fellowship and a stimulating interachange of ideas.

Treasure Mountain Research Retreat VI

Purpose

The purpose of Treasure Mountain VI was to explore the theories and strategies which apply to improving the quality of information use by students and teachers in a variety of educational settings. Emphasis was placed on how library and information skills can be presented within the context of "information literacy" and best consolidated across the typical curriculum structures found in our nation's elementary and secondary schools.

Generally, previous studies and publications have established useful models for the process of search and location of information. These models have provided a foundation for exercises in which students may determine relevant use of information, but may not always be guided in such decisions, nor have such judgments evaluated. In the decade prior to this retreat, some methods for effective assessment of the information search process and final presentation of the product have been suggested. To further clarify those assessment methods and to expand such to a wider information skill set was also part of the intended purpose of this retreat.

Therefore, the intent was to target the broad area in the center of the information use continuum. To explore the possible interventions for media specialists, teachers, parents, and peers in order to move the student information user to a more meaningful experience in the analysis, synthesis, and application of information.

Process

The purpose and possible concepts for this retreat were formulated by three professors who currently teach graduate courses dealing with student behavior and instructional techniques relevant to school library media programs. Daniel Callison is associate professor and director of library science and school media at Indiana University. His research areas include student behaviors in use of electronic information systems. Joy H. McGregor is assistant professor at Texas Woman's University. Based on her interest in how students approach research assignments, her professional research involves analysis of how young people think and their cognitive processes as they use information. Ruth V. Small is associate professor of information studies at Syracuse University. Her research interests focus on the impact of multimedia information on cognitive processes, motivation, and learning outcomes.

Callison and McGregor first discussed the possibility of the sixth retreat with David V. Loertscher in 1995. Small was invited by Callison to join in the planning process for Treasure Mountain VI because of her expertise in motivational theory. All three TM6 planners had served as participants in previous research retreats.

Callison, McGregor, and Small established the purpose of the retreat and defined the areas for possible manuscripts through a list of questions which are given below. A call for papers and participants was issued in early spring 1996. Proposals were reviewed and sixteen individuals were invited to author manuscripts.

The following statement from *Building Knowledge for a Nation of Learners: a Framework for Education Research 1997*, was given by Callison as one of the fundamental reasons for the continuation of the Treasure Mountain Research Retreats when he opened the TM6 session:

> Today's learners are expected not only to acquire information but to use it to make sense of their world. They are encouraged to relate facts and concepts they learn in school to issues and challenges they face in their families and communities. We can expect no less of the research that informs their education. Research that looks at education in a vacuum, without considering the problems and issues that saturate the communities in which it takes place, cannot lead to effective improvement strategies. We need research rooted in the realities of learners' everyday experience and flow of classroom life. Education research is most powerful when it gives all of us tools to help us learn from our experiences in ways that make use better learners and teachers.

Questions

The call for papers included a list of questions from which potential authors were asked to consider as areas for discussion, conceptual framework, or research study.

Expanding the questioning process across the research project.
- Are there levels in the question raising process?
- Do or should questions change and evolve through analysis and synthesis of information? Is there a question-building cycle which evolves from novice to experienced student researcher?

The impact of audience on the process.
- Does the value and interpretation of information change in relationship to the audience who will receive the student's product?
- Does the student change as his/her own audience through self-reflection and maturing? How might the use of portfolio evaluation instruments help the student experience this growth?

Coaching and modeling.
- What role should library media specialists play in coaching students through the analysis and synthesis stages?
- Is there any impact on student use of information which results from teacher and media specialist modeling effective use of information?
- In what manner should school library media specialists and teachers extend conversations with students so that true information needs and interests are identified?
- How does student motivation affect information use and how does information use affect student motivation? What role does the library media specialist play in motivating students?

What ideas and strategies may we draw from educational theory, such as constructivist approaches, for establishing richer opportunities for the information use process? How do the experiences and knowledge students bring to the inquiry process change the development of the research process? How do we get adequate understanding of these pre-research project experiences and knowledge? Do such experiences and pre-project knowledge levels have any impact on the expectations we should have of student performance at the information analysis and synthesis stages?

What can be done to reduce the abuse and misuse of information?
- Do we reward simple transfer of information?
- Can we expect and reward transformation of information?
- Are there elements of form which are always more important in the student presentation of information than the student's intended message?

What behaviors (on the part of teachers, library media specialists, students, or parents) promote or limit effective information use? What do teachers and library media specialists do that sends a signal to students that particular student behaviors (such a plagiarism) will be accepted, regardless of what teachers and librarians tell them? What behaviors do teachers and library media specialists practice which distract from the effectiveness or meaning of what we tell students about information use? What behaviors reinforce what we say?

What should determine the inquiry topics for students: collection, curriculum, student concerns, community concerns, student ability and interests? Or a combination of these and other elements? Do the new information technologies move the inquiry process away from established "stable" collections and curriculum? In what ways do non-linear technologies (multimedia) affect information seeking and learning outcomes?

In what manner should library media specialists and teachers model and evaluate the process of diagnosing information needs? To what extent can we expect students to learn such diagnostic skills? What important elements must be in place to provide a constructive conversation with the student leading to a focus that is meaningful and useful?

What is the potential for "information linkage" practice and discussion for creating an environment in which students and teachers identify greater relevance from information, transform information, and see new patterns in the information? Do exercises in information comparisons lead to additional skills not yet identified in the given models for the information search and use process?

What broad meaning(s) of literacy should we consider? In what manner might various definitions of literacy impact our thinking on development of information process skills? Does information analysis and synthesis change across various subject disciplines and across various definitions of literacy? What instructional implications should we draw from current definitions of "information literacy" and "media literacy"?

What is the difference between "student talk" and "teacher talk" in the information use process? How do we work toward more emphasis in quality student discussion as a part of the information analysis and synthesis process?

Can traditional methods of learning assessment be applied in nontraditional learning environments (interactive learning, constructivist learning)? Must we create new learning assessment models? What assessment methods provide adequate measurement of higher order thinking skills?

Papers

Callison, McGregor, and Small served as editors for the papers selected for publication in this book. Small provided the outline used for organization of the final papers for publication.

Part One: Keynote Addresses:

The eighteen papers selected for publication here include the notes and comments from the two keynote speakers for the retreat. Carol Collier Kuhlthau, associate professor at Rutgers the State University of New Jersey, opened the retreat with her overview of constructivist theory of learning and how it provides a strong theoretical framework for school librarianship. In 1987, Kuhlthau's article "An Emerging Theory of Library Instruction" was published in School Library Media Quarterly. Over the following decade, that essay along with her book Teaching the Library Research Process have significantly influenced the research and practice of helping students obtain and use information in a meaningful way.

Michael B. Eisenberg, professor at Syracuse University, was the keynote speaker for the second day of the retreat. Eisenberg focused on the concept of information literacy and how teaching strategies for that area are operationalized through information problem-solving. He updated his work on the use of The Big6 Skills in a variety of instructional settings and a wide range of age groups. Eisenberg is co-author with Robert Berkowitz of the books Curriculum Initiative and Information Problem-Solving.

Part Two: Issues in Information Literacy:

Six papers include discussion of various aspects of the issues related to information literacy. Mary S. Dalbotten provides an extensive review of the Inquiry Graduation Standards now in effect in Minnesota. Joy McGregor and Denise Streitenberger suggest that instructional interventions based on format and rules may have some effect on limiting the amount of blatant copying by students in the research paper composition process. Majorie L. Pappas and Ann E. Tepe provide a comparison of literacies in media, technology, and information. Daniel Callison and Carol Tilley outline the commonalities between information and media literacies. Dian Walster outlines ideas for library media specialists to consider when teaching information literacy to bilinqual and multilingual students. David Loertscher and Wayne Reeves explore the phenomenon of the information explosion and how the rapid expansion creates a challenge for those who want to determine how students can best survive in an information-rich environment. A key question is raised. Is it possible to research and predict the best practices for instruction in information use when the information environment expands and changes faster than practicing researchers can observe, monitor and measure the instructional possibilities?

Part Three: Teaching and Learning Information Skills:

Eight manuscripts explore the issues related to the teaching and learning of information skills. Michael Havener and Kathy Latrobe review basic psychosocial theories and extract possible insights relevant to understanding the information-seeking behavior of high school honor students. James O. Carey reviews characteristics of learning outcomes and environments that define higher-order learning in information literacy and describes some guidelines from two branches of cognitive psychology for designing information literacy instruction. Regina B. Moody describes a process of locating, interpreting, and evaluating information within sources, and she suggests methodologies for classroom teachers and school library media specialists to use while instructing and coaching students in these skills. Consideration is given to the students' need for distinguishing types of writing, and their understanding of the external and internal organization of expository text.

Linda de Lyon Friel reports the results of a study in which she examined the behaviors of low-achieving high school freshmen as they experienced the information search process. Based on the research of Kuhlthau and Mellon, she documents the effect of interventions by the school library media specialist to help students move through the research tasks. Mark W. Gordon explores the importance of developing and applying critical and reflective thinking to the virtual electronic libraries now encountered daily. He describes techniques, based on actual practice, for dealing with massive lists of references engendered by World Wide Web search engines.

Ruth Small gives an overview of some theories and concepts of motivation and their relationship to library and information science skills. Julie I. Tallman reports on effective teaching and learning strategies modeled and applied through the student-centered I-Search method. Carol L. Tilley and Daniel Callison outline instructional techniques which should be tested to determine the value of cognitive apprenticeship in the teaching of information literacy.

Part Four: Information Literacy Assessment:

Blanche Woolls discusses how to teach critical thinking, ways to recognize critical thinking behavior when it occurs, and how to measure critical thinking performance in students. Robert Gover, Jacqueline McMahon Lakin, and Jane Dickerson report on the progress of their efforts to engage library media specialists in Kansas in the teaching of information skills as part of an integrated curriculum advocated by Quality Performance Accreditation. An interdisciplinary assessment model is proposed.

Participants

Dan Barron
Kay Bishop
Jan Buchanan
Daniel Callison
James O. Carey
Mary Dalbotten
Carol A. Doll
Michael Eisenberg
Sybil M. Farwell
Linda A. Forrest
Susan G. Fowler
Linda Friel
Carrie Gardner
Mark W. Gordon
Robert Grover
Violet H. Harada
W. Michael Havener
James K. Horn
Carol Kroll
Carol C. Kuhlthau
Jackie Lakin
Vivian Landfair
Kathy Latrobe
David V. Loertscher
Gloria McClanahan
Joy H. McGregor
Joan S. Michie
Regina B. Moody
Paula Montgomery
Delia Neuman
Dianne Oberg
Marjorie L. Pappas
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Ruth Small
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Julie Tallman
Nancy Teger
Ann Tepe
Nancy P. Thomas
Carol L. Tilley
Dick Trzicky
Katina VanCronkhite
Mary Ann Hill Walker
Dian Walster
Blanche Woolls
Cathleen Yetter
Anne Zarinnia
Mary Frances Zilonis

History

Treasure Mountain I — October 17-18, 1989 — Park City, UT
The Research of School Library Media Centers
(Papers published by Hi Willow Research & Publishing)

Treasure Mountain II — June 28-29, 1991 — Atlanta, GA
Information Literacy
(A summary of papers published in: *School Library Media Annual*, vol. 10, 1992)

Treasure Mountain III — October 19-20, 1992 — Annapolis, MD
Researcher Practitioner Partnerships: Applying
Qualitative Methodologies to School Settings
(A summary of papers published in: *School Library Media Annual*, vol. 11, 1993)

Treasure Mountain IV — June 15, 1993 — New Orleans, LA
and IVa — December 5, 1993 — New Brunswick, NJ
The Power of Reading: The Effect of Libraries and
Reading Promotion on Reading Competence
(A summary of papers published in: *School Library Media Annual*, vol. 12, 1994)

Treasure Mountain V — November 8, 1994 — Nashville, IN
Future Scenarios for School Library Media Programs
(A summary of papers published in: *School Library Media Annual*, vol. 13, 1995)

Treasure Mountain VI — March 31-April 1, 1997 — Portland, OR
Instructional Interventions for Information Use
(Papers published b y Hi willow Research & Publishing)

Future

Proposals for future Treasure Mountain Retreats should be sent to the attention of David V. Loertscher, Professor, San Jose State University, School of Library and Information Science, One Washington Square, San Jose, CA 95192-029. A portion of the profits from the sale of this publication will be invested in support of future Treasure Mountain Retreats.

---Daniel Callison, Indiana University
---Joy H. McGregor, Texas Woman's University
---Ruth V. Small, Syracuse University

Part One

Keynote Addresses

Constructivist Theory for School Library Media Programs

Lecture Notes for Keynote Address
Carol Collier Kuhlthau

Abstract

These lecture notes frame the keynote address by Professor Carol Kuhlthau of Rutgers University. Some parts of the notes are in full paragraphs and others are lists that were expanded on in the lecture. Although the lecture is not presented in its entirety, an overview can be derived from the notes. The theme of the lecture is that the Constructivist theory of learning provides a strong theoretical framework for school librarianship. This developing theory is compatible with the leading edge research into restructuring schools. The close relationship of practice, research, and theory is emphasized and a call is made for research that provides direction for addressing the critical question of what instructional interventions enable learning in library media centers in the information age school.

I. Introduction

Ten years ago I wrote an article for *SLMQ* entitled, "An Emerging Theory of Library Instruction." In that paper I recalled that in the sixties and seventies school librarians were developing new library media centers and primarily concerned with facilities, staffing, and collections. Library skills instruction evolved during this time at the grassroots level in response to the need to help children find materials in a particular library. As library media centers became more established, library instructional programs continued to be refined and improved, usually at the building level by individual library media specialists. In the eighties our attention turned to the program of the library media center, with primary consideration for development of the instructional role of the library media specialist and integration of the library media program into the curriculum of the school. During this time the objectives of library media programs broaden from developing library skills to information skills and began to move toward information literacy. In the nineties, the infusion of technology has taken much of our time and attention away from learning in libraries to getting equipment up and running and keeping it running. Although these new technologies offer wonderful opportunities for learning in information rich environments that could not be imagined in earlier decades, there is more to learning than merely providing access to more technology and materials.

II. Constructivist Approach to Learning

During these past ten years we have come a long way toward arriving at a strong theoretical foundation for school librarianship. If you look over our research in the past ten years you see a steady path toward building a theoretical foundation for the library media center in the information age school. The theoretical foundation for school librarianship that has emerged is a constructivist approach to learning.

What is most exciting is that this developing theory is completely compatible with the findings from the leading edge research into restructuring schools, i.e. Sizer at Brown; Neumann at University of Wisconsin; and others.

A constructivist theory of learning centers on the student in the active process of moving from uncertainty to understanding rather than the transmission of facts centering on sources and texts. A constructivist theory is the basis of authentic learning approaches that are emerging as one of the most promising findings in the research to restructure schools for the information age. Authentic learning, as described by Neumann and his colleagues at the University of Wisconsin, involves constructing knowledge through guided inquiry that has value beyond the school.

III. Primary Concepts from Educational Theory

Let's look back over the framework of this theoretical base and think a bit about some primary concepts in educational theory that inform our thinking about authentic learning in library media centers.

1. Children learn by building on what they already know.
   (Schema theory - Piaget's theory of accommodation)
   (Construct theory - Kelly's theory of personal constructs)

2. Children learn by being actively engaged and reflecting on their experience.
   (Dewey - reflective thinking; Bruner - interpretative task)

3. Children's development occurs in a sequence of stages.
   (Developmental psychology - Piaget - before the age eleven or twelve children have difficulty with research assignments requiring abstraction. Example - pulling ideas from two or more sources and integrating as a new piece)

4. Children have different ways of learning.
   (Cognitive style; learning style; multicultural learning patterns; special needs; multiple intelligences - Gardner)

5. Children learn through social interaction with others.
   (Social construction - Blumer in Grover; Bruner)

IV. Primary Concepts from Information Science

Now let's look at some basic concepts from Information Science for the theoretical framework of information seeking that informs our thinking about the process of learning from a variety of sources of information.

1. Information Seeking is a sensemaking or meaning making process.
   (Dervin et al - sensemaking; Kuhlthau - seeking meaning)

2. People experience different stages of information need.
   (Belkin - anomalous state of knowledge (ASK)
   (Taylor - levels of information need visceral, conscious, formal, and compromised)

3. The user's judgment of relevance may not match the system's determination of relevance.
   (Saracevic; Schamber, et al - concept of relevance)

4. Total concentration on systems and sources without acknowledging the learning process is not helpful to users in more complex tasks.
   (system vs. user orientation - Dervin and Nilan)
   (technology vs. user centered -Bates; Borgman; Solomon; Neuman; Marchonini)

V. Information Seeking is a Process of Construction

Research in school librarianship has a major contribution to make to this framework by providing an understanding of learning in information rich environments that strengthens the theoretical base for restructuring schools for the information age. Our research also contributes to underlying conceptualizations in information science for addressing the complicated problems associated with providing information systems for people in an information society.

In the eighties important conceptualizations of learning in library media centers began to appear in our literature: Mancall, Aaron, and Walker, 1986; Callison, 1986; Stripling and Pitts, 1989; Irving, 1986, to name a few. Since then related research has been growing and reaching something of a critical mass with the such work as that of McGregor; Pitts; along with many others.

My own research in this area began in the early 1980's. A process approach to learning in libraries has been the central concept in my research into the information search process (ISP). This research is solidly grounded in the everyday practice of the school library media specialist. As you know, I was a library media specialist in a high school when I was struck by the difficulty of getting students engaged in the research process. The problem was right there before me but I needed extensive research to go beyond my initial hunches to understand the complicated learning process that students were experiencing. I noticed that there was something more going on beyond locating a group of sources when students were assigned a research project. But only through extensive study was I able to fully understand why collection of sources was by far the easier part of the ISP. The more difficult part was exploring ideas within the sources to formulate a personal perspective, in other words, the process of construction or the learning process. I also found that the two processes, location and interpretation, were inextricably interconnected. No longer could we think of the research process as separate from the process of learning, writing, and presenting. The six stage process model of the ISP provided a basic theory for school librarianship and a very practical one at that. It could be use directly with students to talk to them about what stage they were in and what strategy might fit that stage.

After some hard thinking I realized that the findings of the studies of the student's perspective of information seeking indicated that there were two different somewhat conflicting perspectives at work: the library perspective emphasizing order and organization and the student perspective emphasizing confusion and uncertainty. I presented this concept in my book, *Seeking Meaning* as an uncertainty principle for library and information services. When we apply an uncertainty principle to library media programs we realized that we need to intervene with students in very different ways than when we hold a theory of providing sources that stops short of learning from those sources. Therefore the concept of a zone of intervention was developed as a basis for determining when to intervene with students and when to leave them to their own devises. From that concept came the definition of different levels of intervention for instruction and reference called levels of mediation and education. This theory continues to evolve through my studies of students and others in actual situations of learning from a variety of sources.

What was emerging ten years ago as some concepts about the process of information seeking has developed into pervasive theoretical approach. Some of the practical applications for library media programs were brought together by Eisenberg and Brown 1992 in an *SLMQ* research column comparing the approaches recommended by Irving; Stripling and Pitts; Eisenberg and Berkowitz; and Kuhlthau. However, this is an evolving area calling for continuing rigorous research. The main objective of this approach is to move beyond the mechanics of technology, location, and presentation to center on student learning and creative thinking.

VI. Relation of Practice, Research, and Theory

What is the relationship between practice, research, and theory. We have a serious problem in our field regarding resistance to research and theory. I still hear library media specialists say, "Don't tell me about theory. I want something that I can use on Monday morning." What is theory and how can it be useful to library media specialists on "Monday morning?" A theory is a conceptualization of a complex combination of ideas and facts. "A theory may be considered as a way of binding together a multitude of facts so that one may comprehend them all at once (Kelly)." Theory enables us to rise above the seemingly random confusion of everyday life to see patterns and to understand principles on which to base purposeful, productive action. It provides a frame of reference for acting in everyday life. We all hold theories and act upon them.

Much needs to be done! As researchers we must continue to ask if our research has had the impact on practice that is needed? We need to continue to build on the interaction between practice, research, and theory. Our responsibility as researchers:

- to come to a general understanding of the underlying theoretical framework
- to build on what we already know; refine and verify
- to translate to the field

There is more to research than conducting a study and reporting on it. Hard thinking over a sustained period of time is essential. There are two things that the researcher needs to do. First, to continue the investigation for refinement, verification, and understanding of a problem. Second, to think long and hard about the findings and develop conceptualizations that contribute to the theoretical framework of the field. Many good studies have not been taken beyond the initial investigation to contribute to the theoretical framework that impacts library media specialists in their daily work with students and teachers.

VII. Conflicting Theories of Practice

We have described a theoretical foundation for school librarianship, but what are the theories held by library media specialists? The theories that they are acting on in their daily practice. We all have theories that form the basis of our action. It is important to know what theories library media specialists hold? Here are a few conflicting theories that I have noted that work against adoption of the constructivist or process approach to learning from a variety of sources.

1. Strong emphasis on resources and technology often obscures the library media specialist role in student learning.
2. Transmission model of learning is still pervasive often impeding the constructive process of learning from a variety of sources.
3. Emphasis is often on logistics and mechanics of information use rather than on the process of learning.

In studies where I compared successful programs with struggling programs I found a number of enablers and inhibitors (Kuhlthau, 1993). When library media specialists were asked "What problems do you have?" in more successful programs, library media specialists emphasized problems directly related to student learning, such as the problem of helping students to form a focus for their research. In struggling programs, library media specialists emphasized logistical problems, such as insufficient time, resources, poor assignments. These logistical problem however real distracted attention from student learning.

During the past few years, I have been investigating library media specialists perceptions of learning by elicited examples of learning that they have observed. What library media specialists emphasize to describe learning has been drawn from these examples. Does the library media specialist emphasize input, output, attitude, skills, or application. In preliminary analysis of the data, there is evidence over time of some movement from emphasis on sources (input and output) to skills. But for the most part library media specialists haven't made that last step of applying sources and technology for learning. We need research to provide direction for addressing the critical the question of what instructional interventions enable learning in library media centers.

VIII. Research into Instructional Interventions for Information Use

Let's explore some of the research ideas that we might pursue to continue to build a theoretical base that is eminently practical for creating an environment of authentic learning the information age school. These are some of the ideas that I have been thinking about. I am sure you have many to add to the list that contribute to the broad range of questions and problems related to a constructivist approach to learning in the information age school.

1. The concept of a Zone of Intervention
   (from Vygotsky "zone of proximal development") That area in which a student can do with advice and assistance what he or she cannot do alone or can do only with great difficulty (Kuhlthau, Seeking Meaning) Identifying the zone of intervention and knowing what to do to help students in that zone.

2) Caution about developing interventions without research
   (example - Gothenburg study on deep processing found that too much structure can result in shallow processing.)
   Too much structure/ too little guidance/ too few strategies structure that doesn't allow process.
   Questioning process - what kind of probes and prompts are helpful? harmful? whose question is it? extrinsic/ intrinsic motivation
   What do we emphasize? What do we reward?
   Simple transfer of information; plagiarism; emphasis on product or
   Creative process of learning from information; reflection, interpretation, construction; emphasis on understanding

3) Research into structure, guidance, strategies; instructional interventions
   Stages of cognitive development:
   - k-5 expanding knowledge base
   - 6-7 transition to using more abstraction in learning
   - 7-12 forming a focused perspective within the ISP

   Strategies for different stages in the ISP:
   Strategies for exploring - listing ideas, interesting facts, emerging questions
   Strategies for collecting - taking detailed notes, supporting a point of view

Intervention strategies for further research (Kuhlthau, 93, 94, 96, 97)
- Collaborating
- Conversing
- Continuing
- Choosing
- Charting
- Composing

IX. Research Theme

The process of construction in information rich environments is a substantial theoretical framework for school librarianship. The theory is compatible with the leading edge research in education and learning. Although a good theory is alive and evolving, we don't need to start from ground up in every study. We have a good foundation on which to build. We need research that not only relates to practice, but lifts practice to a higher level. It is our responsibility to address the needs of practitioner by refining and verifying interventions that lead to constructive learning. It is our responsibility to present our research findings so that library media specialists can use them. It is our responsibility to clearly articulate the underlying theoretical framework that it enables library media specialists to be experts on learning in the information age school. We can do this together. To take up Warren Bennis challenge from his recent book, *Organizing Genius*, it is time to organize our research into "a dream with a deadline."

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Author Biographical Notes

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Transparencies Used

EDUCATIONAL THEORY

1. CHILDREN LEARN BY BUILDING ON WHAT THEY ALREADY KNOW
2. CHILDREN LEARN BY BEING ACTIVELY ENGAGED AND REFLECTING ON THEIR EXPERIENCE
3. CHILDREN'S DEVELOPMENT OCCURS IN A SEQUENCE OF STAGES
4. CHILDREN HAVE DIFFERENT WAYS OF LEARNING
5. CHILDREN LEARN THROUGH SOCIAL INTERACTION WITH OTHERS

INFORMATION SCIENCE THEORY

1. INFORMATION SEEKING IS A SENSEMAKING OR MEANING MAKING PROCESS
2. PEOPLE EXPERIENCE DIFFERENT STAGES OF INFORMATION NEED
3. THE USER'S JUDGMENT OF RELEVANCE MAY NOT MATCH THE SYSTEM'S DETERMINATION OF RELEVANCE
4. TOTAL CONCENTRATION ON SYSTEMS AND SOURCES WITHOUT ACKNOWLEDGING THE LEARNING PROCESS MAY NOT BE HELPFUL TO USERS IN MORE COMPLEX TASKS

The Big 6™ Skills: Looking at the World Through Information Problem-Solving Glasses

Michael B. Eisenberg
Carrie A. Lowe

Abstract

The concept of information literacy is gaining increasing and widespread attention as educators focus on preparing students for success in the Age of Information. Information literacy can be operationalized as "information problem-solving," and this paper articulates several of the common themes which can be found in the body of research and documented practice related to information problem-solving. These themes give an indication of the current state of the concept of information literacy, as well as the direction that related research might take in the future. The author also provides an update on his own efforts concerning the Big6™ Skills approach to information problem-solving, and gives his thoughts on the future of information literacy in education.

Introduction

Our time has come. Information literacy is now gaining widespread acceptance among a broad audience. What was once an idea known only to those in the library media field has become one of the main components for educational reform. President Clinton addressed this priority in a recent radio address, saying, "We have to do everything we can to make technology literacy a reality for every child in America" (1997). It is becoming widely acknowledged that, in order to prepare students for success in the age of information, they must be taught information literacy.

But what is information literacy? Asking educators or information professionals will likely provide a range of answers. For example, there are a number of information skills models, e.g., Pitts/Stripling, Pappas/Tepe, Kuhlthau, and the Eisenberg/Berkowitz Big6 model. What is encouraging, however, is that there are more similarities among the models than differences. The driving force behind these models is "process" - the understanding that information skills are not isolated incidents, but rather connected activities that encompass a way of thinking about and using information.

The purpose of this paper is to articulate some of the common themes which can be found in all major models of information problem-solving. Looking at these main themes gives an indication of where we are in developing the idea of information literacy and where we are going.

This paper is also an update on my own research. For the first(Woolls, 1988) Treasure Mountain Research Retreat (TMRR), Michael Brown and I prepared a paper on information skills instruction and the state of research in the area at that time (Eisenberg and Brown, 1988). Since then, a great deal of progress has been made by researchers looking at information problem solving. I am pleased to have the opportunity to update that report, by describing my research ideas as well as the work of others. All of these studies strongly underscore the importance of information problem-solving instruction and the need for this type of instruction in the curricula of all students.

Information Problem-Solving

Of course, I am rather myopic when it comes to information literacy. Bob Berkowitz and I have been teaching, presenting, writing about, and basically living the Big6 for over ten years. The Big6 skills for Information Problem-Solving is a model we created to describe the steps which occur in successful information problem-solving (Eisenberg and Berkowitz, 1988, 1990) The six steps are:

1. Task Definition
2. Information Seeking Strategies
3. Location and Access
4. Use of Information
5. Synthesis
6. Evaluation

The Big6 Skills is a flexible, non-linear model which can be integrated into any content area easily.

Our work with the Big6 has resulted in my tendency to see the world through "Big6 glasses." In other words, it seems that I am constantly coming across events and actions that relate to the Big6 in every area of my life. This shouldn't come as a great surprise, because there is growing recognition of the extent to which information literacy and information skills pervade everyday life.

This fact was made clear to me in a recent episode of the television cartoon show *The Simpsons*. In this episode, Bart must learn to play miniature golf to prepare for a competition. He is at a complete loss on how to approach the problem, and turns to his sister Lisa who offers to help. A trip to the library gives them the information they need to make Bart a successful miniature golfer. In solving this information problem, the Simpson children use all steps of the Big6:

- Task definition - focusing on the problem and the information requirements
- information seeking strategies - using the library
- location and access - using the library catalog
- use of information - reading and sharing the information
- synthesis - applying "geometry" to the golf problem
- evaluation - realizing that it worked

Another example of the widespread applicability of the Big6 is in the movie *Apollo 13*. In one part of the film, a broken air filter threatens to cause the spacecraft to run out of breathable air. To save the lives of the astronauts, the ground crew must find a way to make a different type of air filter work in place of the broken one, using only the materials the astronauts have available. After a good deal of experimentation, the ground crew solves the information problem, just in time. As with the Simpsons example, the people in this scene can be seen using all of the Big6 steps with special emphasis on task definition, information seeking strategies, use of information, and synthesis. Solving this information problem is one of the most exciting points in the movie.

Use of the Big6 can also be seen in sporting events. A football game, for instance, is essentially an information problem pitting one information system against another. In order to win, the coaches need to gather, assess, and synthesize information form the situation (such as weak area of the other team and strengths of his/her own team) and use this information to devise a winning strategy (for example, which play to run). Ultimate evaluation is very easy to determine—check out the scoreboard at the end of the game.

The idea that "information is everywhere" is the basis of my view of information literacy. Information is a pervasive and essential part of our society, and indeed, our lives. We are, at our essence, processors and users of information. This is not a recent development. Humans have always been dependent upon information to help make decisions and guide our actions. Change has come in the sheer volume of information and the complexity of information systems—largely due to advances in information technology and the accelerated rate at which we live our lives. In a speech at the 1997 National Educational Computing Conference in Seattle, Bill Gates recently stated that computing power has increased one million times over the past 20 years and will likely do so again in the next 20!

Recognizing the pervasive nature of information and the importance of information problem-solving skills is the key to where we, as researchers and educators, are and where we are going. It is our responsibility to understand the nature of information and the way that people use it, so that we can insure that all individuals have the opportunity to learn the information literacy skills they will need in the future to successfully navigate the future landscape of information.

Research

In my earlier TMRR paper, I focused on four areas of library and information skills instruction and the research addressing it (Eisenberg and Brown, 1992):

1. The value of library and information skills instruction.
2. The nature and scope of library and information skills.
3. The integrated approach to teaching library and information skills.
4. Alternative methods of teaching library and information skills.

At that time, there was limited research addressing these questions. since the, research has increased substantially. Some of the most significant research relates to the nature of the information process and the impact of information skills instruction, e.g., Kuhlthau (1993) and Ross Todd (1996). Kuhlthau's work, in particular, offers a solid research base for the processes underlying information problem-solving.

The focus of my own research has also sharpened in the five years since the last TMRR; now that the Big6 is widely recognized as a model for information problem solving, I am looking at the ways the Big6 is actually being used. the main areas that we are currently studying in relation to the Big6 are:

- Sufficiency: whether the steps included in the Big6 are sufficient to describe information problem-solving behavior.

- Necessity: if all of the steps including in the Big6 are necessary to solve information problems, and if they are equally important to ensure successful completion of an information problem.

- Pervasiveness: Whether recognized characteristics of the Big6 remain constant across settings and environments.

- Impact: What kind of effect teaching individuals the Big6 has upon their information problem-solving behavior, and whether differences are measurable in terms of performance in solving information problems and attitudes about information problem-solving.

A preliminary study investigated the sufficiency and necessity questions. Researchers interviewed a small (15) sample of people about information problems they had solved. Using a sense-making methodology (Dervin and Nilan, 1986), participants were asked to describe a problem and the steps that they took to complete it. The participants where then taught the Big6 process, and asked to reconsider the steps they took in solving their problem in light of the Big6. The participants found that, although they did not realize it, the steps that they took in solving their problems were actually steps in the Big6. Most of the participants noted that the Big6 would help them to solve information problems more effectively in the future, and planned to make a conscious effort to do so when solving future information problems.

Again, this is only a preliminary effort, and I plan to extend this study to look at different groups of people and the way they use information to solve problems. The results of the first study seem to confirm Kuhlthau's (1993) research. Solving information problems is an iterative, flexible process rather than a rigid series of steps. Also the Big6 model does appear to adequately describe the process, i.e., all the steps taken can be explained using the Big6 Skills.

There are several other areas of information literacy and information skills instruction that I am also interest in investigating. A few of these are:

- The relationship of technology in information problem-solving and information skills instruction, as well as its impact on them. This is an area which will extend some recent curriculum work undertaken with Dough Johnson (Eisenberg and Johnson 1996).

- Information problem-solving and information skills instruction as part of the overall information base used in many different settings. Ruth Small and I have begun work on a classification system to describe and distinguish the information bases used in a variety of educational settings (Eisenberg and Small, 1998).

- The extent of information problem-solving instruction in schools, both across the United States and world-wide. This will involve compiling a directory of schools using the Big6 and other models.

- The roles of key placer (such as library and information studies professors, teachers, students, and partners) in information problem-solving and information literacy instruction.

This is the current state of my research agenda in information problem-solving and information literacy. As noted, my work has led me to see the world through Big6 glasses, and I invite you to join me. Not necessarily to see life from a Big6 perspective, but to take a broard, pervasive view of information processes in our society.

Conclusion: Taking a Broad View and Acting Upon It

Emphasizing information processes and information skills instruction insures the viability of our field and the success of our students in the future. Our future is dependent upon having a board view of information processing; it is not just a skill that we use in the library, but a way to live our lives. Passing these skills on to our students is the way that we will deliver on the promise of *Information Power*, to ensure that students are effective users of information and ideas (AASL, 1988).

We are not alone in recognizing the centrality and importance of information processing to information literacy. This idea has become an important one in the press, where each day brings a new batch of stories and articles about information technologies and how they can be used. The promise of information power has been recognized at the federal level, as well, with new initiatives being put into place to educate our children in information and technology skills. Our leaders are beginning to recognize that making students effective users of information means more than ensuring that they are able to do keyboarding or use an interactive program; we must promote information problem-solving as a holistic, process-based approach.

It is time for us to become active participants in the information literacy debate on the national level. To do this, we must begin to get the message out about what we know, about what works, and about what doesn't. We need to use what we have learned as the basis for educating new and current library and information professionals, thereby ensuring that they are giving their students the legacy of *Information Power.* We must continue to look forward into the future of our profession in our writing, research, and teaching.

There are also actions which we, as leaders in our field, must take to ensure that our own viability. We must:

- Look at the world through information process glasses, and teach our students to do the same.
- Educate all library and information professionals of the importance of an information literacy world-view.
- Continue to champion information and technology literacy and active library and information specialists and programs in every possible situation
- Continue to conduct quality research, and expand the existing research base.
- Think big—This is important stuff!

With respect to where we have been, and a clear vision of where we are going, let's put on our glasses together and continue working.

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Author Biographical Notes

Michael B. Eisenberg (Ph.D., Syracuse University, MLS, State University of New York at Albany) is a Full Professor at the School of Information Studies, Syracuse University. Mike also serves as Director of the ERIC Clearinghouse on Information and Technology. The unifying aspect of Mike's diverse teaching and research activities is the ongoing effort to improve society's ability to meet people's information needs. Mike strives to accomplish this through education of information professionals, conducting research, consulting, writing and presenting on the use of information and information technology in education and training; information problem-solving and development of essential information and technology skills; development and management of Internet services and resources; and the curriculum concerns and management of library media programs.

Mike is a frequent speaker at conferences, presents numerous workshops and training sessions each year, and consults with school districts businesses, and government agencies on information resources, services, curriculum, technology, and management. He has worked as a teacher, library media specialist, program administrator, and consultant. Mike is co-founder and co-coordinator (with Peter Milbury) of LM_NET, the electronic discussion group on the Internet for the library media community, and is Director of the award-winning AskERIC Internet services project.

Carrie Lowe earned her bachelor's degree in Secondary Education and English from the University of Wisconsin-Madison. This program gave her the opportunity to teach in a variety of alternative settings. She is currently a master's student in the Library science program at the school of Information Studies, Syracuse university. While earning this degree, Carrie has been involved with a variety of research projects, and has had the chance to lead classes at the undergraduate and graduate level. She is currently a Column Editor for the *Big6™ Newsletter,* and hopes to continue her studies at the Ph.D. level.

Part Two

Issues in Information Literacy

Inquiry in the National Content Standards

Mary S. Dalbotten

Abstract

Setting high graduation standards is a national trend. This trend challenges library media specialists to help students meet high standards and work with teachers to implement performance assessments. One of the High Standards (content standards) within Minnesota's Graduation Standards is called Inquiry. Inquiry includes information literacy skills and more. This paper will include descriptions of:

- Minnesota's Graduation Standards
- an Inquiry Process that is common to all of Minnesota's Inquiry Standards
- Inquiry as manifested in the national content standards of 12 disciplines.

Introduction/Problem: What does information analysis and synthesis (Inquiry) look like in various disciplines?

At one of the early Treasure Mountain Research Retreats, Ann Irving described how she approaches information skills with teachers and students in the different disciplines. Basically, she elicits their search strategies and the terms they use to describe them. Those are the terms she uses when she works with them on their research or inquiry. Neva Kamrath, a media specialist in a rural Minnesota school district, said "I see my role as one of teaching transfer." I asked her what she meant. She said, "One week a student came to me struggling with a 'thesis statement' for an English class and I helped him with it. The next week, he was confused about what a 'hypothesis' was in his science class. I helped him see the similarities between the two." Minnesota's Inquiry Process calls these "question." Eisenberg and Berkowitz (1990) in *Information Problem-Solving: The Big Six Skills Approach to Instruction* calls them "task definition." While the terms may not mean exactly the same thing, there are similarities.

Minnesota's Inquiry Process evolved from the development of content standards in the Profile of Learning, the High Standards in Minnesota's Graduation Standards (See Appendix A). Inquiry is one of ten broad areas of learning within the Profile of Learning. One strategy for finding out how Inquiry looks across the disciplines is to examine the national standards publications and map them to the Inquiry Process as defined by Minnesota's Center for Student Performance and the Information Problem-Solving Process. General statements about inquiry and information skills are described in the text of this paper. Charts containing specific statements from the national content standards compared to the steps in these two inquiry/problem-solving processes are found in Appendix B. The conclusions and interpretations are the author's and not those of the Minnesota Department of Children, Families and Learning.

Minnesota's Graduation Standards Purpose

The Minnesota Legislature in 1992 made a "commitment to establishing a rigorous, results-oriented graduation rule for Minnesota public school students." The rule defines requirements that students must achieve to earn a diploma. Graduation Standards are being developed that will prepare Minnesota's students for living and working in their communities. Graduates also need skills to compete internationally and to continue learning in a changing world.

The first group of students scheduled to graduate under a portion of the new Graduation Standards are those who entered ninth grade in fall, 1996—the graduating class of 2000. To earn a diploma, these students must achieve the Basic Standards in reading and mathematics. Students entering ninth grade in 1997 must achieve the Basic Standards in reading, mathematics, and written composition. The High Standards under the Profile of Learning are scheduled to take effect in 1998. Students graduating from high school in 2002 may be the first group to meet all the requirements of the new Graduation Standards.

Components of Minnesota's Graduation Standards

There are three components to Minnesota's Graduation Standards (See Appendix A). They are the Comprehensive Goals, Basic Standards, and the High Standards (Profile of Learning).

Minnesota's Comprehensive Goals for Education

The Minnesota State Board of Education established five goals for Minnesota's public education system. The five goals will give students the education they need to function effectively as purposeful thinkers, effective communicators, self-directed learners, productive group participants, and responsible citizens. The Graduation Standards are closely aligned with these goals.

Graduation Standards

Minnesota's Basic Standards. Minnesota's Basic Standards are the areas in which students must meet or exceed the required level of achievement in order to receive a diploma. The state will set the required levels of achievement, although local school districts have the option to set higher measures for their students. To meet Minnesota's Basic Standards, students must demonstrate competency in the skills of reading, mathematics and written composition.

Minnesota's High Standards—Profile of Learning. The Profile of Learning provides the framework for high academic standards that all Minnesota students will be encouraged to achieve. Within the Profile, there are ten broad areas of learning. The ten areas of learning and the summary statements are:

- Read, View, Listen—Read, view and listen to complex information in the English language
- Writing and Speaking—Write and speak effectively in the English language
- Arts—Use and interpret the arts
- Mathematics—Solve problems by applying mathematics
- Inquiry—Conduct research and communicate findings
- Sciences—Understand and apply scientific concepts
- People and Cultures—Understand interaction between people and cultures
- Decision Making—Use information to make decisions
- Managing Resources—Manage resources for a household, community or government
- Languages—Communicate in another language

Each area of learning is supported by High Standards at four levels of development—primary, intermediate, middle and high school. The High Standards are content standards that define what a student should know and be able to do in order to reach a high level of performance. The state will establish which High Standards students are required to work in, and which are optional.

Student achievement of the High Standards will be evaluated using a variety of assessment measures. In addition to the pencil-and-paper tests most commonly used to gauge learning, students also will be required to demonstrate that they can apply their knowledge in simulated real-life situations. Performance assessments are being developed for students to demonstrate their achievement.

Role of the Pilot Sites

To assist in developing and implementing the new Graduation Standards, the Department of Education selected 14 pilot site districts. They include urban, suburban, and rural districts across the state of Minnesota. During the 1993-94 school year, the pilot sites developed content standards, now known as High Standards. They then developed performance packages for the standards that all districts in the state can use. These packages will become true performance assessments once performance standards are set and exemplars of student work is available. The pilot sites also are developing methods to report and track a student's progress in the Basic Standards and the Profile of Learning throughout high school.

The pilot sites' experiences will provide valuable information about the strengths and weaknesses of the standards and the training and resources needed to implement them. Pilot sites will test all portions of the standards before other districts implement them. The first phase in the training and implementation of the High Standards began in the summer of 1996. Inquiry is the first area of learning within the Profile of Learning to be phased in by school districts.

Definition of Inquiry and the Inquiry Process

The Center for Student Performance is responsible for approving all of the performance assessments developed to meet the High Standards. As the Center staff worked with the Inquiry High Standards and the performance assessments designed to meet them, they discovered a common sequence across the disciplines. The Inquiry Process generally follows this sequence:

- Generate question/hypothesis
- Determine feasibility
- Collect data (primary and/or secondary)
- Reduce and organize data
- Display data
- Compile conclusions and/or more questions

When the steps are listed in this manner, they appear to be linear, when in actuality they are cyclical or recursive. Inquiry in real life is messy and chaotic. For example, before the researcher can ask good questions, he/she may have to do some preliminary research or collect some data. Or, in the middle of organizing the data, the researcher may discover the need for collecting more data. The researcher often must move back and forth between the stages of inquiry.

The Office of Graduation Standards defines Inquiry and the Inquiry process as follows:

"**Inquiry-** (as it applies to the High Standards) The "nickname" of the fifth broad area of learning known as "Conduct research and communicate findings." There are 16 content standards in Inquiry at the high school level, 3 at the middle level, 2 at the intermediate level, and 1 at the primary level..." (Minnesota Department of Children, Families and Learning, July 19, 1996, p. 5)

The 16 high school content standards under Inquiry are in the areas of Language Arts, Mathematics, Science, Social Studies, Arts (including Media Arts), Business Education, Technology Education, Agriculture, plus Family Life and Consumer Science. The Inquiry standards at the primary, intermediate, and middle levels are more general and cross-disciplinary.

> "**Inquiry Process-** An approach to finding out something one doesn't know or wishes to understand. To do this, a specific research method or other method of Inquiry may be used. Regardless of the method, the overall process requires that students apply analysis, synthesis, and evaluation skills as they find and use information and make generalizations. The Inquiry process more or less follows this sequence: a) generate a question, b) determine the feasibility of getting data to answer the question, c) select the

method(s) for collecting data, d) collect the data (includes secondary and primary sources), e) reduce and organize the data, f) compile conclusions and/or more questions." (Minnesota Department of Children, Families and Learning, July 19, 1996, p. 5)

What is central to the Inquiry Process is that students will apply analysis, synthesis, and evaluation skills as they find and use information and make generalizations.

Information Problem-Solving (the "Big 6")

The Information Problem-Solving model developed by Michael Eisenberg and Bob Berkowitz (1990) is similar to the Inquiry Process discovered by the Center for Student Performance as it designed Inquiry performance packages for students. Comparing the two shows the similarities:

Minnesota's Inquiry Process	Information Problem-Solving
Generate questions	1. Task Definition 1.1 Define the problem 1.2 Identify the information requirements of the problem
Determine feasibility	2. Information Seeking Strategies 2.1 Determine the range of possible sources. 2.2 Evaluate the different possible sources to determine priorities.
Collect data	3. Location and Access 3.1 Locate sources 3.2 Find information within sources
Reduce and organize data	4. Use of Information 4.1 Engage (Read, hear, view) the information in a source. 4.2 Extract information from a source.
Display data	5. Synthesis 5.1 Organize information from multiple sources 5.2 Present information
Compile conclusions/more questions	6. Evaluation: 6.1 Judge the product (effectiveness). 6.2 Judge the information-solving process (efficiency).

While there is not a perfect one-to-one correspondence between Minnesota's Inquiry Process and the Information Problem-Solving Model, they are similar. They are both used as organizing principles for the inquiry and information skills found in the national content standards publications. (Appendix B)

Inquiry and Information Problem-Solving in the National Content Standards

This section includes quotes from the national standards publications that relate to Inquiry or Information Problem-Solving. These quotes appear in the introductory sections, glossaries, and descriptions of the standards. Most of the actual content standards are placed under the most appropriate Inquiry and Information Problem Solving processes in the charts in Appendix B.

English/Language Arts

Source: National Council of Teachers of English. (1996). *Standards for the English Language Arts.* Urbana, IL: Author

> The following excerpts from *Standards for the English Language Arts* demonstrate how Inquiry and Information Problem-Solving are expressed in the area of English/Language Arts.
>
> The ability to use language for a variety of purposes is therefore another essential part of the learning experience. . . In particular, we recommend a focus in English language arts education on four purposes of language use: for **obtaining and communicating information**, for literary response and expression, for learning and reflection, and for **problem solving and application**. (author highlights) (National Council of Teachers of English, 1996)

For Obtaining and Communicating Information. Nonfiction, informational books, magazine articles, documentary films, encyclopedia entries on paper or CD-ROM, catalogs, interviews, recordings of news broadcasts, schedules, and instructions—we use all of these types of texts to get information about topics that interest us or to find out something we need to know. Similarly, we create many different kinds of texts to convey information to others, ranging from diagrams, verbal directions, and simple reports on observations of natural phenomena to laboratory reports and multimedia research projects. By learning to use many different media—traditional and nontraditional, print and nonprint—to collect and convey information, students become aware of the range of possibilities available to them for communicating with others. Building on the information-gathering and presentation skills that students use routinely in everyday life, teachers can strengthen students' ability to perform more complex and challenging tasks and to enhance their learning in other curriculum areas. (National Council of Teachers of English, 1996)

For Problem Solving and Application. Students use language every day to solve problems and grapple with issues that concern them. To respond to these situations and demands, students need to be able to use language to pose significant questions, to become informed, to obtain and communicate and information, and to think critically and creatively. (National Council of Teachers of English, 1996)

How Students Should Be Able to Use Language

Strategically

Students need to be able to use a wide range of strategies (including predicting, hypothesizing, estimating, drafting, synthesizing, and identifying words and their meanings) to interpret and create various types of texts. (National Council of Teachers of English, 1996)

Critically

Students develop the ability to pose questions as they read, listen, and view: What inferences can I draw from this text? What perspective does this text ask me to assume? What viewpoint is presented in this text? What does this text omit or distort? How is my own response related to what is presented by the text? (National Council of Teachers of English, 1996)

While critical thinking is often concerned with making distinctions and marking differences, effective critical thinkers also draw connections among texts, their own responses to them, various bodies of knowledge, and their own experiences. Development of critical language skills enables students to provide informed opinions about texts they encounter, and to support their interpretations with multiple forms of evidence. (National Council of Teachers of English, 1996)

The specific content standards from the *Standards for the English language arts* that relate to inquiry and information problem-solving are:

> 7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
>
> 8. Students use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

In describing Standard 7, the authors make a clear distinction between "research" and "inquiry." "It is essential that students acquire a wide range of abilities tools for raising questions, investigating concerns, and solving problems. In school, "research" is the name commonly given to the processes for addressing such concerns. However, a rigid view of research as a series of mechanical steps misrepresents the complexity and creative potential of human problem solving and limits the range of educational experiences that can help students. Perhaps the idea of research is best considered in terms of inquiry—the learner's desire to look deeply into a question or idea that interests him or her. Viewed in this way, research becomes an investigation into an issue or problem chosen by the student. It involves posing interesting and substantive questions, identifying and securing multiple data sources, analyzing and synthesizing data, and positing findings or new understandings.

"Language itself is a valuable research tool. The ability to use language to seek out and refine interesting questions, plan predict, investigate, analyze, hypothesize, and speculate gives students a way to frame and address the issues that they encounter in academic subjects as well as in everyday life. "(National Council of Teachers of English, 1996, p. 38)

In describing Standard 8, the authors say "students need to use new technologies to gain access to databases, bibliographies, other data resources, and computer users around the world, and they need to develop skill in synthesizing this broad base of information." (National Council of Teachers of English, 1996, p. 40)

Finally, **inquiry** is defined in the glossary of the *Standards for the English Language Arts* as "a mode of research driven by the learner's desire to look deeply into a question or an idea that interests him or her." (National Council of Teachers of English, 1996, p. 73)

Foreign Language

Source: *Standards for Foreign Language Learning: Preparing for the 21st Century.* (1996). Lawrence, KS: Allen Press.

The introduction to this publication states that "it is this focus on content (i.e., gaining access to information in a range of areas of inquiry and human activity) that may have the most lasting impact on our students in the future." (*Standards for Foreign Language Learning,* 1996, p. 31)

Critical Thinking Skills."...they develop the ability to use a variety of references to seek and incorporate entirely new knowledge in the performance of the tasks. Given a set of cultural issues or problems, they learn to identify, organize, and analyze issues or problems so as to express informed opinions, arrive at informed conclusions, and propose solutions to problems. They can also reflect upon and evaluate the quality and success of their communication so as to strengthen the nature of their interactions in the future." (*Standards for foreign language learning* 1996)

The following sample learning scenario demonstrates the incorporation of two inquiry-related standards—3.2 Acquiring Information and 5.2 Lifelong Learning.

Research Portfolio

TARGETED STANDARDS
1.2 Interpersonal Communication
1.3 Presentational Communication
3.2 Acquiring Information
5.2 Lifelong Learning

Second year students in Gwinett County complete an in-depth study of a Spanish-speaking country in this hemisphere in a multi-step process during the semester. In the school media center, the high school students are introduced to the "Countries of the World" CD-ROM program and DC Newsbank, in addition to traditional resources in the form of encyclopedias, maps, etc. Some of the reference sources are available in Spanish. The students produce a portfolio with the following components: a travel brochure describing the country they select; an article in Spanish from the media resources, as well as three pictures, maps and/or drawings; a biography of a famous person from the country; the recipe of a national dish; a song (performed and recorded on an audio or videotape); and an item of the student's choice related to the environment, economics, or politics. The portfolios are kept in the classroom for later use as reference.

Reflection

1.2 Students read the information provided on the CD-ROM and in print.
1.3 Students prepare materials for inclusion in the portfolio.
3.2 Students acquire information from authentic documents
5.2 Students consult resources to obtain information on a topic of interest.

This activity demonstrates to students how to access information from the community on a topic of interest. Technology applications are made during this process as students make selections for inclusion in the portfolio. Students are guided through the process, but are also allowed to select an item related to their own interest. The fact that the portfolio will remain in the classroom as a resource for other students makes this activity highly motivating and relevant for the students. The teacher could include peer editing in the process in order to improve the level of accuracy in the materials developed. (*Standards for Foreign Language Learning,* 1996)

Geography

Source: Bednarz, S. W. and others. *Geography for Life; National Geography Standards,* 1994. Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.

Geographic Skills. This publication has a special section on geographic skills and perspectives. "Geographic skills provide the necessary tools and techniques for us to think geographically...We use geographic skills when we make decisions important to our well-being—where to buy or rent a home; where to get a job; how to get to work or to a friend's house; where to shop, vacation, or go to school. All of these decisions involve the ability to acquire, arrange, and use geographic information..." (Bednarz, 1994)

"Geographic skills help us to make reasoned political decisions. Whether the issues involve the evaluation of foreign affairs and international economic policy or local zoning and land use, the skills enable us to collect and analyze information, come to an informed conclusion, and make reasoned decisions on a course of action. Geographic skills also aid in the development and presentation of effective, persuasive arguments for and against matters of public policy." (Bednarz, 1994)

"The geographic skills that a geographically informed person should have consist of five sets adapted from the Guidelines for Geographic Education: Elementary and Secondary schools, prepared by the Joint Committee on Geographic Education and published in 1984 by the Association of American Geographers and the National Council for Geographic Education." (Bednarz, 1994, p. 42)

The five sets of geographic skills are:

1 Asking Geographic Questions
2. Acquiring Geographic Information
3. Organizing Geographic Information
4. Analyzing Geographic Information
5. Answering Geographic Questions

There are excellent, brief descriptions of the principles underlying the five skill sets on pages 42-44 of the National Geography Standards. The last paragraph of the fifth set of skills - those of Answering Geographic Questions, describes the cyclical nature of inquiry. It is similar to the "Conclusions/ More Questions" step in Minnesota's Inquiry Process. It states: "The fifth skill set represents the last step in the process of geographic inquiry. But it is not really the end, because the process usually begins again with new questions suggested by the conclusions and generalizations that have been developed. These questions, often posed as hypotheses to be tested, provide a way to review generalizations. Each question answered, decision reached, or problem solved leads to new issues and new problems. Geographic learning is a continuous process that is both empowering and fascinating." (Bednarz, 1994, p. 44) In addition, many of the 18 geography standards have inquiry and information skills embedded within them.

Health

Source: Joint Committee on National Health Education Standards. (1995). *National Health Education Standards.* American Cancer Society.

The National Health Education Standards begin by defining Health Literacy and the health literate person. Health literacy is "the capacity of individuals to obtain, interpret, and understand basic information and services and the competence to use such information and services in ways which enhance health." This is virtually identical to the definition of the information literate person, with only the reference to health making it specific to this curriculum area. The health literate person is:

- a critical thinker and problem solver
- a responsible, productive citizen
- a self-directed learner
- an effective communicator
  (Joint Committee on National Health Education Standards, 1995, p. 5)

These roles are also virtually identical to the Comprehensive Goals in Minnesota's Graduation Standards (See Appendix A) which are:

- Purposeful Thinker
- Effective Communicator
- Self-Directed Learner
- Productive Group Participant
- Responsible Citizen

The National Health Education Standards describe three of these life roles in terms of an information literate person, who is specifically literate in the area of health. Excerpts from these descriptions follow:

Critical Thinker and Problem Solver - They utilize a variety of sources to access the current, credible, and applicable information required to make sound health-related decisions. (Joint Committee on National Health Education Standards, 1995)

Self-Directed Learner - Health-literate individuals are self-directed learners who have a command of the dynamic health promotion and disease prevention knowledge base. They use literacy, numerical skills, and critical thinking skills to gather, analyze, and apply health information as their needs and priorities change throughout life. (Joint Committee on National Health Education Standards, 1995)

Effective Communicator - Health-literate individuals are effective communicators who organize and convey beliefs, ideas and information about health through oral, written, artistic, graphic and technologic mediums. (Joint Committee on National Health Education Standards, 1995)

Health Education Standards. The two standards that specifically address information skills and their rationales are the following:

2. Students will demonstrate the ability to access valid health information and health-promoting products and services.

Rationale

Accessing valid health information and health-promoting products and services is important in the prevention, early detection, and treatment of most health problems. Critical thinking involves the ability to identify valid health-promoting services and products. Applying skills of information analysis, organization, comparison, synthesis, and evaluation to health issues provides a foundation for individuals to move toward becoming health literate and responsible productive citizens. (Joint Committee on National Health Education Standards, 1995)

4. Students will analyze the influence of culture, media, technology, and other factors on health.

Rationale

Health is influenced by a variety of factors that co-exist within society. These include the cultural context as well as media and technology. A critical thinker and problem solver is able to analyze, evaluate, and interpret the influence of these factors on health...(Joint Committee on National Health Education Standards, 1995)

History

Source: National Center for History in the Schools. (1996). *National Standards for History.* Los Angeles, CA: Author.

"In history, standards are of two types:

1. Historical thinking skills that enable children to differentiate past, present, and future time; raise questions; seek and evaluate evidence; compare and analyze historical stories, illustrations, and records from the past; interpret the historical record; and construct historical narratives of their own.

2. Historical understandings that define what students should know about the history of families, their communities, states, nation, and world. These understandings are drawn from the record of human aspirations, strivings, accomplishments, and failures in at least five spheres of human activity: the social, political, scientific/technological, economic, and cultural (the philosophical/ religious/aesthetic), as appropriate for children.

"Historical thinking and understanding do not, of course, develop independently of one another. Higher levels of historical thinking depend upon and are linked to the attainment of higher levels of historical understanding. The standards presented provide an integration of historical thinking and understanding" by highlighting and placing the historical thinking skill in brackets after the historical understanding, for example, "Use a variety of visual data, fiction and nonfiction sources, and speakers to identify the groups that have come into the state or region and to generate ideas about why they came. **[Obtain historical data]**" (National Center for History in the Schools, 1996, p. 2) "Obtain historical data" is the particular thinking skill selected to serve as an example of the integration of historical thinking and historical understanding, but it is not the only one that can be used with this historical understanding.

There is also a set of six Basic Principles guiding the development of standards for K-4. The last Basic Principle is the following (highlighting mine):

6. All these resources should be used imaginatively to help children **formulate questions** for study and to support historical thinking, such as the ability to **marshal information**; **create sound hypotheses**, locate events in time and place; compare and contrast past and present; explain historical causes and consequences; **analyze historical fiction and illustrations for their accuracy and perspectives**, and **compare primary sources** that accurately portray life, attitudes, and values in the past; compare different stories about an era or event in the past and the interpretations or perspectives of each; and **create historical narrative** of their own in the form of stories, letters such as a child long ago might have written, and descriptive accounts of events. (National Center for History in the Schools, 1996, p. 3)

There are five Historical Thinking Standards in grades K-4. While all of these standards pertain to Inquiry, the fourth standard—**The student conducts historical research**—is directly related to Inquiry. Under this standard, the student is able to:

A. **Formulate historical questions:...**
B. **Obtain historical data** from a variety of sources, including: library and museum collections, historic sites, historical photos, journals, diaries, ...and so on
C. **Interrogate historical data** by ...testing the data source for its credibility, authority and authenticity; and detecting and evaluating bias, distortion, and propaganda by omission, suppression or invention of facts.
D. **Marshal needed information** of the time and place in order to construct a story, explanation, or historical narrative. (National Center for History in the Schools, 1996, p. 22)

"Meaningful historical inquiry proceeds with the formulation of a problem or set of questions worth pursuing. In the most direct approach, students might be encouraged to analyze the document, record, or site itself. ...obtaining needed background information can send students on a search for additional resources" one of which is the school library. (National Center for History in the Schools, 1996, p. 22)

The other four standards under Historical Thinking Skills are also very closely related to research and inquiry. Examples follow:

Standard 2: The student comprehends a variety of historical sources:

F. **Draw upon data in historical maps...**
G. **Draw upon the visual and mathematical data presented in graphs**, including charts, tables, pie and bar graphs, etc.
H. **Draw upon the visual data presented in photographs, paintings, cartoons, and architectural drawings** in order to clarify, illustrate or elaborate upon information presented in the historical narrative. (National Center for History in the Schools, 1996, pp. 19-20)

Standard 3. The student engages in historical analysis and interpretation.

A. **Formulate questions to focus their inquiry and analysis.** (National Center for History in the Schools, 1996, p. 21)

Standards for United States and World History, Grades 5-12

The definition of historical thinking skills is slightly different for Grades 5-12 than Grades K-4. "In history, standards are of two types:

> 1. Historical thinking skills that enable students to evaluate evidence; develop comparative and causal analyses, interpret the historical record; and construct sound historical arguments and perspectives on which informed decisions in contemporary life can be based.
>
> 2. Historical understandings that define what students should know about the history of their nation, and of the world. These understandings are drawn from the record of human aspirations, strivings, accomplishments, and failures in at least five spheres of human activity: the social, political, scientific/technological, economic, and cultural (the philosophical/religious/aesthetic), as appropriate for children. (National Center for History in the Schools, 1996, p. 43)

Criteria for the Development of Standards for United States and World History, Grades 5-12 (National Center for History in the Schools, 1996, p. 43)

Two criteria particularly relate to research and inquiry. They are as follows:

6. All historical study involves selection and ordering of information in light of general ideas and values. Standards for history should reflect the principles of sound historical reasoning—careful evaluation of evidence, construction of causal relationships, balanced interpretation, and comparative analysis. The ability to detect and evaluate distortion and propaganda by omission, suppression, or invention of facts is essential.

7. Standards should include awareness of, appreciation for, and the ability to utilize a variety of sources of evidence from which historical knowledge is achieved, including written documents, oral tradition, quantitative data, popular culture, literature, artifacts, art and music, historical sites, photographs, and films.
The study of history involves much more than the passive absorption of facts, dates, names, and places...Real historical understanding requires students to think through cause-and-effect relationships, to reach sound historical interpretations, and to conduct historical inquiries and research leading to the knowledge on which informed decisions in contemporary life can be based.

The five types of historical thinking for grades 5-12 are the same as those given for K-4. They are:

- Chronological thinking
- Historical comprehension
- Historical analysis and interpretation
- Historical research
- Historical issues-analysis and decision-making

The standards in historical thinking are integrated with the standards in historical understanding by highlighting the thinking standards in brackets at the end of each historical understanding.

The fourth standard - **The student conducts historical research** is directly related to Inquiry and is virtually identical to the historical thinking standard described for Grades K-4 above, as is **Standard 2: The student comprehends a variety of historical sources** and **Standard 3: The student engages in historical analysis and interpretation.** At this level, Grades 5-12, the publication discusses the need to go beyond the textbook: "Hence the importance of providing students with documents or other records beyond materials included in the textbook, that will allow students to challenge textbook interpretations, to raise new questions about the event, to investigate the perspectives of those whose voices do not appear in the textbook accounts, or to plumb an issue that the textbook largely or in part bypassed." (National Center for History in the Schools, 1996, p. 67)

Under these conditions, students will view their inquiries as creative contributions, or, as the Minnesota performance model describes it, the students will be doing authentic work, simulating the actions of a true historian.

Mathematics

Source: National Council of Teachers of Mathematics. (1989) *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: Author.

In the Introduction, this publication focuses on the increasing importance of information in its description of the Information Society: "... The relatively slow mechanical means of communication—the voice and the printed page—have been supplemented by electronic communication, enabling information to be shared almost instantly with persons—or machines—anywhere. Information is the new capital and the new material, and communication is the new means of production..." (National Council of Teachers of Mathematics, 1989, p. 3)

There are three standards that especially relate to inquiry and information skills - Mathematics as Problem Solving, Mathematics as Reasoning and Statistics and Probability.

As stated in the grades K-4 section of Standard 1 Mathematics as Problem Solving - "When problem solving becomes an integral part of classroom instruction and children experience success in solving problems, they gain confidence in doing mathematics and develop persevering and inquiring minds. They also grow in their ability to communicate mathematically and use higher-level thinking processes." (National Council of Teachers of Mathematics, 1989, p. 23) In Grades 5-8, the mathematics curriculum should include numerous and varied experiences with problem solving as a method of inquiry and application..." The focus of this standard states that : "Problem solving is the process by which students experience the power and usefulness of mathematics in the world around them. It is also a method of inquiry and application, interwoven throughout the Standards to provide a consistent context for learning and applying mathematics." (National Council of Teachers of Mathematics, 1989, p. 75)

The **Evaluation** Standard for Problem Solving states that "The assessment of students' ability to use mathematics in solving problems should provide evidence that they can

- formulate problems;
- apply a variety of strategies to solve problems;
- solve problems;
- verify and interpret results;
- generalize solutions."
  (National Council of Teachers of Mathematics, 1989, p. 209)

Under Standard 11 Statistics and Probability, it states: "In grades K-4, ...students can–

- collect, organize and describe data;
- construct, read and interpret displays of data;

- formulate and solve problems that involve collecting and analyzing data;
- explore concepts of chance."
  (National Council of Teachers of Mathematics, 1989, p. 54)

"In grades 5-8, ...students can–

- systematically collect, organize and describe data;
- construct, read and interpret tables, charts, and graphs
- make inferences and convincing arguments that are based on data analysis
- evaluate arguments that are based on data analysis
- develop an appreciation for statistical methods as powerful means for decision making
  (National Council of Teachers of Mathematics, 1989, p. 105)

The study of statistics and probability highlights the importance of questioning, conjecturing and searching for relationships when formulating and solving real-world problems. The description of the focus of the statistics and probability standard in grades K-4 is parallel with the Inquiry Process delineated by the Minnesota's Center for Student Performance: "Collecting, organizing, describing, displaying, and interpreting data, as well as making decisions and predictions on the basis of that information, are skills that are increasingly important in a society based on technology and communication. These processes are particularly appropriate for young children because they can be used to solve problems that often are inherently interesting, represent significant applications of mathematics to practical questions, and offer rich opportunities for mathematical inquiry. " Further, "A spirit of investigation and exploration should permeate statistics instruction. Children's questions about the physical world can often be answered by collecting and analyzing data. After generating questions, they decide what information is appropriate and how it can be collected, displayed, and interpreted to answer their questions. The analysis and evaluation that occur as children attempt to draw conclusions about the original problem often lead to new conjectures and productive investigations." (National Council of Teachers of Mathematics, 1989, p. 54) Similar, but more advanced, standards are expected of students in grades 5-8 and 9-12.

Physical Education

Source: National Association for Sport & Physical Education. (1995) *Moving into the Future: National Physical Education Standards: A Guide to Content and Assessment.* St. Louis, MO: Mosby.

There were no standards that clearly dealt with inquiry or information skills. However, "Standard 4. Achieves and maintains a health-enhancing level of physical fitness" calls upon secondary students to "design and develop an appropriate personal fitness program that enables them to achieve desired levels of fitness." (National Association for Sport & Physical Education, 1995, p. 3) In order to do this, students would need to use data-gathering and other information skills. Standard 5 expects a student to demonstrate "responsible personal and social behavior in physical activity settings." (National Association for Sport & Physical Education, 1995, p. 3) In order to do this, students become involved in decision-making processes that would also require the application of information skills. One of the assessment examples under the "physically active lifestyle" standard asks students "to develop a chart that can be used to identify opportunities in the school and community for regular participation in physical activity." In order to complete the chart, "students should be encouraged to gather the information and to organize their chart for ease of locating information about the various activities. Information can be summarized by creating a general class chart created from the information on the individual charts." (National Association for Sport & Physical Education, 1995, p. 50-51) One of the emphases for the twelfth grade student under Standard 4 is to "design a personal fitness program." (National Association for Sport & Physical Education, 1995, p. 95) This could easily be an extensive inquiry process.
In the appendix, the description of a Student Project includes parts of the Inquiry Process, and more. "Student projects provide for a range of strategies and results including the following: the application of the processes of data collection, goal setting, planning, analysis, decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.)" (National Association for Sport & Physical Education, 1995, p. 109)

Science

Source: *National Science Education Standards.* (1996). Washington, DC: National Academy Press.

Scientific inquiry is central to the first **teaching** standard, "Teaching Standard A: Teachers of science plan an inquiry-based science program for their students" "Inquiry into authentic questions generated for student experiences is the central strategy for teaching science. Teachers focus inquiry predominantly on real phenomena, in classrooms, outdoors, or in laboratory settings, where students are given investigations...that are demanding but within their capabilities." (*National Science Education Standards,* 1996, p.31)

"As more complex topics are addressed, students cannot always return to basic phenomena for every conceptual understanding. Nevertheless, teachers can take an inquiry approach as they guide students in acquiring and interpreting information from sources such as libraries, government documents, and computer databases—or as they gather information from experts from industry, the community, and government. Other teaching strategies rely on teachers, texts, and secondary sources—such as video, film, and computer simulations. When secondary sources of scientific knowledge are used, students need to be made aware of the processes by which the knowledge presented in these sources was acquired and to understand that the sources are authoritative and accepted within the scientific community." (*National Science Education Standards,* 1996, p. 31)

The first **content** standard for students —"Content Standard A: Science as Inquiry"—develops in complexity as the student matures.

In grades K-4, all students should develop the following abilities necessary to do scientific inquiry:

- ask a question about objects, organisms, and events in the environment
- plan and conduct a simple investigation
- employ simple equipment and tools to gather data and extend the senses
- use data to construct a reasonable explanation
- communicate investigations and explanations

In grades 5-8, all students should develop the following abilities necessary to do scientific inquiry:

- identify questions that can be answered through scientific investigations (Students should develop the ability to refine and refocus broad and ill-defined questions...and identify their questions with scientific ideas, concepts and quantitative relationships)
- design and conduct a scientific investigation
- use appropriate tools and techniques to gather, analyze and interpret data (Students should be able to access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes)
- develop descriptions, explanations, predictions, and models using evidence
- think critically and logically to make the relationships between evidence and explanations (*National science education standards,* 1996, p. 145)

In grades 9-12, all students should develop the following abilities necessary to do scientific inquiry:

- identify questions and concepts that guide scientific investigations (Students should formulate concepts guiding a hypothesis and the design of an experiment)
- design and conduct scientific investigations
- use technology and mathematics to improve investigations and communications
- formulate and revise scientific explanations and models using logic and evidence
- recognize and analyze alternative explanations and models (...although there may be several scientific criteria to find the preferred explanations)
- communicate and defend a scientific argument

(*National Science Education Standards,* 1996, p. 175)

Social Studies

Source: National Council of the Social Studies. (1994) *Expectations of Excellence: Curriculum Standards For Social Studies.* Washington, DC: Author.

Expectations of Excellence: Curriculum Standards for Social Studies has an appendix titled "Essential Skills for Social Studies" (In Search of a Scope and Sequence for Social Studies, 1989, p. 376-385) in which are detailed listings of information skills including reading skills, study skills, reference & information-search skills, technical skills unique to electronic devices, thinking skills, decision-making skills, and metacognitive skills.

In addition, within most of the ten thematic strands, such as Culture or Civic Ideals & Practices, there are references to inquiry and information skills. Examples from the ten thematic strands at high school level follow:

1. Culture
h. explain and apply ideas, theories, and modes of inquiry drawn from anthropology and sociology in the examination of persistent issues and social problems. (National Council of the Social Studies, 1994, p. 33)

II. Time, Continuity & Change
d. systematically employ processes of critical historical inquiry to reconstruct and reinterpret the past, such as using a variety of sources and checking their credibility, validating and weighing evidence for claims, and searching for causality; (National Council of the Social Studies, 1994, p. 34)

III. People, Places & Environments
c. use appropriate resources, data sources, and geographic tools such as aerial photographs, satellite images, geographic information systems (GIS), map projections, and cartography to generate, manipulate, and interpret information such as atlases, data bases, grid systems, charts, graphs, and maps; (National Council of the Social Studies, 1994, p. 35)

V. Individuals, Groups, & Institutions
h. explain and apply ideas and modes of inquiry drawn from behavioral science and social theory in the examination of persistent issues and social problems. (National Council of the Social Studies, 1994, p. 38)

VI. Power, Authority & Governance
h. explain and apply ideas, theories, and modes of inquiry drawn from political science to the examination of persistent issues and social problems; (National Council of the Social Studies, 1994, p. 39)

X. Civic Ideals & Practices
c. locate, access, analyze, organize, synthesize, evaluate, and apply information about selected public issues—identifying, describing and evaluating multiple points of view; (National Council of the Social Studies, 1994, p. 45)

Technology Education

Sources: Hutchinson, J, and Karsnitz, J. (1994). *Design and problem solving in technology.* Albany, NY: Delmar.

Todd, R. D., Todd, K. R., and McCrory, D. L. (1995). *Introduction to design and technology.* Cincinnati, OH: Thomson Learning Tools.

Standards for Technology Education are still in process. There are, however, some current textbooks that shed light on how the inquiry process is expressed in technology education. The texts cited above describe a design process that is very similar to inquiry.

Technology for All Americans: A Rationale and Structure for the Study of Technology states: "Technological design requires an understanding of the use of resources and engages a variety of mental strategies, such as problem solving, visual imagery, and reasoning." (International Technology Association, 1996, p. 18.)

Hutchinson and Karsnitz describe the design process as recursive, in the same way that the inquiry process is recursive. They call it a design loop and describe it as follows: "You should understand that designing is not a linear process; that is, when you design and make something, you do not think and act in separate, sequential steps. The creative process of designing is more like switching back and forth between a thinking-questioning-evaluating mode and an acting-doing mode. These modes have been called the 'active' and 'reflective' phases of design, and you are constantly moving between the two.

"What this process of moving back and forth between the active and reflective phases means is that you will probably need to jump around a bit during your designing. For example, if you get to the point of choosing a solution and it occurs to you that you need a bit more background, you will need to revisit the step 'investigation and research.' Or, if you are building the chosen solution and find a fatal flaw that will not allow you to complete that solution you will have to go back to the step where you looked at 'generation of alternative solutions' and pick another solution. There is nothing wrong with doing this. The design loop should provide you with a framework for your design and problem-solving work, and help keep you on track." (Hutchinson, 1994, p. 18-19)

Todd, Todd, and McCrory describe the cyclical nature of the design process as follows: "Often, the first time through the Design Loop on any problem helps focus on what the problem actually is. It is quite common to cycle through the Design Loop several times...The experiences you gain each time you go through the design process helps you ask better questions. Often, these questions become more meaningful and penetrating relative to the overall problem and its context as well as its parts." (Todd, 1995, p. 17)

The design loops from both of these texts show clearly how inquiry is manifested in the field of technology education.

Summary and Conclusions

This chart shows which content standards publications have statements or standards that relate to each of the steps in Minnesota's Inquiry Process. All require students to demonstrate that they can organize and display data. All of the disciplines, except Civics, require students to collect data. Steps that are missing in three of the disciplines are generating questions and determining feasibility and/or determining which sources best fit their inquiry needs. One discipline does not include the step of compiling conclusions.

Minnesota's Inquiry Process	National Standards
Generate questions	All disciplines except Foreign Languages and Health
Determine feasibility	All disciplines except Civics and Foreign Languages
Collect data	All disciplines except Civics
Reduce and organize data	All disciplines
Display data	All disciplines
Compile conclusions/more questions	All disciplines except History

Social Studies and two of its sub-disciplines—Geography and History—have separate sets of inquiry-like skills. The Essential Skills for Social Studies are Acquiring Information, Organizing & Using Information, and Interpersonal Relationships & Social Participation. Acquiring Information includes reading skills, study skills, reference and information-search skills, and technical skills unique to electronic devices. Organizing and Using Information includes thinking skills such as "synthesize information," decision-making skills, and metacognitive skills. Geography has five sets of Geographic Skills which include all steps in the Inquiry Process from asking geographic questions to analyzing geographic information. History has historical thinking skills which include comprehending a variety of historical sources and conducting historical research.

Science has an entire standard devoted to Science as Inquiry and mathematics has a problem-solving standard at each of three grade levels. Both include all the steps of the Inquiry Process.

English/Language Arts standards define the general way students elicit information from reading, listening and viewing. There are also standards that describe the research process and specifically the use of technological resources. Foreign languages focus on the use of sources in the target language when preparing reports.

Health standards have a strong standard on accessing and judging health information, as well as one on the influence of media and technology on health. While the Physical Education standards do not have standards specifically dealing with Inquiry, the detailed description of student projects include all the steps in the Inquiry Process.

In the Arts, theatre specifically requires research in reference to cultural and historical information. Dance's description of a "movement problem" includes all the steps of Inquiry. While not explicitly stated in the Arts content standards, it seems that the creation of any artistic product would be inquiry in the truest sense of the word. In Technology Education, the design process is parallel to the Inquiry Process.

In conclusion, inquiry is explicitly or implicitly included in the national standards of all disciplines. This affirms the essential nature of inquiry and information problem-solving as expectations for all students. It also affirms the shift from learning isolated facts to becoming a self-directed learner who uses inquiry skills throughout life. Being aware of all of this, library media specialists can help students transfer their inquiry skills and processes from one discipline to another and to authentic inquiry in real life.

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Current projects include providing workshops for Minnesota school library media specialists on Minnesota's Graduation Standards. Last year (1996-97) the topic was Inquiry and the Library Media Program. This year (1997-98) the topic is Phase II and the Library Media Program. Phase II of the Graduation Standards includes math, science, people and cultures, decision-making and managing resources. Two technology projects call for infusing technology in the Graduation Standards as well as in the four Best Practice networks for reading, writing, math, and science.

Treasure Mountain 6 brought together persons from K-12 schools, state agencies, and higher education. The opportunities for discussing papers brought out several points of view representing these different levels as well as the diversity of opinions between individuals. The learning was enriched by the diversity. Because the focus was information literacy, we were able to explore its many aspects in depth.

Appendix A

Minnesota's Graduation Standards

MINNESOTA GRADUATION STANDARDS
Overview

Comprehensive Goals	Basic Standards	The Profile of Learning... Minnesota's High Standards
	"Saftey Net"	10 Areas of Learning
Purposeful Thinker Effective Communicator Self-Directed Learner Productive Group Participant Responsible Citizen	**Reading, Mathematics** Students who are in ninth grade in 1996-97 and thereafter must pass reading and math tests. **Written Composition** Students who are in ninth grade in 1997-98 and thereafter must pass a written composition test.	1) Read, view and listen to complex information in the English language. 2) Write and speak effectively in the English Language. 3) Apply and interpret artistic expression. 4) Solve problems by applying mathematics. 5) Conduct research and communicate findings. 6) Understand and apply scientific concepts and methods. 7) Understand interactions among people and cultures. 8) Use information to make decisions. 9) Manage resources for a household, community or government. 10) Communicate in a language other than English Each area has content standards at the primary, intermediate, middle, and high school levels. Contents standards are assessed through performance packages. The proposed rule for the High Standards requires students entering ninth grade in '98-99 and thereafter to complete a record of work in at least 24 content standards.

Task Management Skills

• **Resource Management**	• **Time Management**	• **Perserverance**	• **Team Work**

Minnesota Department of Children, Families & Learning 7/6/97

Appendix B

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem-Solving ("Big 6")

Explanation of the Charts

In the charts that follow, Minnesota's Inquiry Process and Eisenberg and Berkowitz's Information Problem-Solving Model ("Big 6") are used as organizing principles for national content standards. Because Minnesota's Inquiry Process and Eisenberg and Berkowitz's Information Problem-Solving Model ("Big 6") are not identical, there is overlap between the columns. The main difference is the breakdown for

reduce data = information use
organize data = synthesis
display data = synthesis

Minnesota's Inquiry Process combines Reduce and Organize Data, while the "Big 6" combines organize and present under Synthesis.

The national content standards documents used are from the Arts (Dance, Music, Theatre, and Visual Arts), Civics and Government, English/Language Arts, Foreign Languages, Geography, Health, History, Mathematics, Physical Education, Science, and Social Studies. The national content standards for Technology Education were not available so two recent textbooks were used to map inquiry and information skills. The left hand column gives the full bibliographic data for the national standards publication in the indicated discipline and the page numbers in the columns refer to the pages within that publication. The second column contains general statements from the national content standards publications that refer to either inquiry or information-problem-solving processes. The rest of the columns contain content standards compared to the Inquiry Process and the Information Problem Solving Process.

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving**	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Arts - Dance Music Theatre Visual Arts Source: Music Educators National Conference. (1994). *National standards for arts education.* Reston, VA: Author		**Dance** - AS Grades 5-8 Create a movement problem p. 40 **Dance** AS Grades 9-12 Formulate and answer their own aesthetic questions p. 57	**Dance**- CS Grades K-4 Apply and demonstrate critical and creative thinking skills in dance p. 24	**Dance**- AS Grades K-4 Explore, discover, and realize multiple solutions p. 24	**Dance**- AS Grades K-4 Explore, discover, and realize multiple solutions p. 24	**Dance**- AS Grades K-4 Choose the most interesting solution p. 24	Dance- AS Grades K-4 Discuss reasons for that choice p. 24
	Theatre - CS Grades K-4 Researching by finding information to support classroom dramatizations p. 31				**Theatre** - AS Grades 5-8 Apply research from print and nonprint sources to script writing, acting, design, and directing choices. p. 47	**Theatre** - AS Grades 5-8 Apply research from print and nonprint sources to script writing, acting, design, and directing choices. p. 47	**Theatre** - AS Grades K-4 Communicate information to peers about people, events, time, and place related to classroom dramatizations p. 31
	Theatre - CS Grades 5-8 Researching by using cultural and historical information to support improvised and scripted scenes p. 47			**Theatre** - AS Grades 5-8 Apply research from print and nonprint sources to script writing, acting, design, and directing choices. p. 47	**Theatre** - CS Grades 9-12 Researching by evaluating and synthesizing cultural and historical information to support artistic choices, p. 66	**Theatre** - CS Grades 9-12 Researching by evaluating and synthesizing cultural and historical information to support artistic choices, p. 66	

CS - Content Standard AS - Achievement Standard

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving**	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Arts - Dance Music Theatre Visual Arts Source: Music Educators National Conference. (1994). *National standards for arts education.* Reston, VA: Author	**Visual Arts** - Grades K-4 - Creation is at the heart of this instruction. They (students) learn to make choices that enhance communication of their ideas. p. 33 **Visual Arts** - AS Grades 9-12 Initiate, define, and solve challenging visual arts problems independently using intellectual skills such as analysis, synthesis, and evaluation p. 70			**Visual Arts** - AS Grades 5-8 **Select media, techniques, and processes;** analyze what makes them effective or not effective in communicating ideas; and reflect upon the effectiveness of their choices p. 50	**Visual Arts** - AS Grades 5-8 Select media, techniques, and processes; **analyze what makes them effective or not effective in communicating ideas;** and reflect upon the effectiveness of their choices p. 50		**Visual Arts** - AS Grades 5-8 Select media, techniques, and processes; analyze what makes them effective or not effective in communicating ideas; and **reflect upon the effectiveness of their choices** p. 50

CS - Content Standard **AS - Achievement Standard**

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving**	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Civics & Government Source: Center for Civic Education. (1994). *National standards for civics and government.* Calabasas, CA: Author.	"evaluate, take, and defend positions..." on a variety of issues in civic education p. 5 Political communication: television, radio, the press, and political persuasion. Students should be able to evaluate, take, and defend positions on the influence of the media on American political life. p. 118	**critical mindedness** - having the inclination to question the (truth - K-4) (validity - 5-8) of various positions, including one's own. p. 80			**"Evaluate a position."** To use criteria or standards to make judgments about the 1) strengths and weaknesses of a position on a particular issue, 2) goals promoted by the position 3) means advocated to attain the goals. p. 5 Grades 9-12 - evaluate historical and contemporary political communication using such criteria as logical validity, factual accuracy, emotional appeal, distorted evidence, appeals to bias or prejudice p. 119	**"Take a position."** To use criteria or standards to arrive at a position one can support 1) one may select from alternative positions, or 2) create a novel position. p. 5 **"Defend a position."** To advance arguments in favor of one's position and 2) respond to or take into account arguments opposed to one's position. p. 5	**"Evaluate a position."** To use criteria or standards to make judgments about the 1) strengths and weaknesses of a position on a particular issue, 2) goals promoted by the position 3) means advocated to attain the goals. p. 5 **"Defend a position."** To advance arguments in favor of one's position and 2) respond to or take into account arguments opposed to one's position. p. 5

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
English/ Language Arts Source: National Council of Teachers of English. (1996) *Standards for the English Language Arts.* Urbana, IL: Author	Students need to be able to use language to pose significant questions, to become informed, to obtain and communicate information, and to think critically and creatively. p. 18	use language to **pose significant questions**, to become informed, to obtain and communicate information, and to think critically and creatively p. 18 pose questions as they read, listen, and view: e.g. What inferences can I draw from this text? p. 21	use language to pose significant questions, to **become informed,** to obtain and communicate information, and to think critically and creatively p. 18	use language to pose significant questions, to become informed, **to obtain** and communicate **information,** and to think critically and creatively p. 18	use language to pose significant questions, to become informed, to obtain and **communicate information,** and to think critically and creatively p. 18	use language to pose significant questions, to become informed, to obtain and communicate information, and **to think critically and creatively** p. 18 use a wide range of strategies (including... synthesizing) to interpret and create various types of texts p. 20	provide informed opinions about texts they encounter, and to support their interpretations with multiple forms of evidence. p. 21

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* Information Problem-Solving**	**Generate Questions* Task Definition****	**Determine Feasibility* Information Seeking****	**Collect Data* Location & Access****	**Reduce & Organize Data* Information Use****	**Display Data* Synthesis****	**Compile Conclusions/ More Questions* Evaluation****
English/ Language Arts Source: National Council of Teachers of English. (1996). *Standards for the English Language Arts.* Urbana, IL: Author	Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience. p. 25	conduct research on issues and interests by generating ideas and questions, and by posing problems. p. 25	**gather,** evaluate and synthesize **data** from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience. p. 25	**gather,** evaluate and synthesize **data** from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience. p. 25	gather, **evaluate** and synthesize **data** from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience. p. 25	gather, evaluate and **synthesize data** from a variety of sources (e.g. print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience. p. 25	gather, evaluate and synthesize data from a variety of sources (e.g. print and nonprint texts, artifacts, people) to **communicate their discoveries in ways that suit their purpose and audience.** p. 25
	Students use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge. p. 25		use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to **gather** and synthesize **information** and to create and communicate knowledge. p. 25			use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and **synthesize information** and to create and communicate knowledge. p. 25	use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and synthesize information and **to create and communicate knowledge.** p. 25

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Foreign Languages Source: *Standards for foreign language learning: Preparing for the 21st century.* (1996) Lawrence, KS: Allen Press.	Standard 1.3 - Presentational Communication Students present information, concepts, and ideas to an audience of listeners or readers on a variety of topics. p. 41 Grade 12 - PI - Students prepare a research-based analysis of a current event from the perspective of both the U.S. and target cultures. p. 42			Standard 3.1 - PI - Grade 12 - Acquire information from a variety of sources written in the target language about a topic being studied in other school subjects. p. 51	Standard 3.1 - PI - Grade 12 - Acquire information from a variety of sources written in the target language about a topic being studied in other school subjects. p. 51	Standard 1.3 - Students present information, concepts, and ideas to an audience of listeners or readers on a variety of topics. p. 41 Standard 3.1 - PI - Grade 8 - Students present reports in the target language, orally and/or in writing, on topics being studied in other classes p. 51	

Progress Indicators (PI) at Grades 4, 8, 12

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Foreign Languages Source: *Standards for foreign language learning: Preparing for the 21st century.* (1996). Lawrence, KS: Allen Press.	Standard 3.2 - Students acquire information and recognize the distinctive viewpoints that are only available through the foreign language and its cultures. p. 52			Standard 3.2 - Acquire information and recognize the distinctive viewpoints that are only available through the foreign language and its cultures. p. 52	Standard 3.2 PI - Grade 12 Students **use a variety of sources** intended for same-age speakers of the target language to prepare reports on topics of personal interest, ... and compare these to information obtained on the same topics written in English. p. 52	Standard 3.2 PI - Grade 12 Students use a variety of sources intended for same-age speakers of the target language **to prepare reports** on topics of personal interest, ... and compare these to information obtained on the same topics written in English. p. 52	Standard 3.2 PI - Grade 12 Students use a variety of sources intended for same-age speakers of the target language to prepare reports on topics of personal interest, ... and **compare these** to information obtained on the same topics written in English. p. 52

Progress Indicators (PI) at Grades 4, 8, 12

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Geography Source: Bednarz, S. W. and others. *Geography for life; national geography standards, 1994.* Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.	The Five Sets of Geographic Skills 1 Asking Geographic Questions 2. Acquiring Geographic Information 3. Organizing Geographic Information 4. Analyzing Geographic Information 5. Answering Geographic Questions p. 54	Skill Set 1 Asking Geographic Questions Plan and organize a geographic research project (e.g. specify a problem, pose a research question or hypothesis and identify data sources) (Grades 9-12) p. 54	Skill Set 2 Acquire Geographic Information Systematically locate and gather geographic information from a variety of primary and secondary sources (Grades 9-12) p. 54	Skill Set 2 Acquire Geographic Information Systematically locate and gather geographic information from a variety of primary and secondary sources (Grades 9-12) p. 54	Skill Set 2 Acquire Geographic Information Systematically assess the value and use of geographic information (Grades 9-12) p. 54	Skill Set 3 Organize Geographic Information Select and design appropriate forms of maps to organize geographic information (Grades 9-12) p. 54 Select and design appropriate forms of graphs, diagrams, tables, and charts to organize geographic information (Grades 9-12) p. 54 Use a variety of media to develop and organize integrated summaries of geographic information (Grades 9-12) p. 54	

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* Information Problem-Solving**	**Generate Questions* Task Definition****	**Determine Feasibility* Information Seeking****	**Collect Data* Location & Access****	**Reduce & Organize Data* Information Use****	**Display Data* Synthesis****	**Compile Conclusions/ More Questions* Evaluation****
Geography Source: Bednarz, S. W. and others. *Geography for life; national geography standards, 1994.* Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.	The Five Sets of Geographic Skills 1 Asking Geographic Questions 2. Acquiring Geographic Information 3. Organizing Geographic Information 4. Analyzing Geographic Information 5. Answering Geographic Questions p. 54					Skill Set 4 Analyze Geographic Information Use quantitative methods of analysis to interpret geographic information (Grades 9-12) p. 54 Make inferences and draw conclusions from maps and other geographic representations (Grades 9-12) p. 54 Use the processes of analysis, synthesis, evaluation, and explanation to interpret geographic information from a variety of sources (Grades 9-12) p. 54	Skill Set 5 Answer Geographic Questions Formulate valid generalizations from the results of various kinds of geographic inquiry (Grades 9-12) p. 54 Evaluate the answers to geographic questions (Grades 9-12) p. 54 Apply geographic models, generalizations, and theories to the analysis, interpretation, and presentation of geographic information (Grades 9-12) p. 54

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* Information Problem-Solving**	**Generate Questions* Task Definition****	**Determine Feasibility* Information Seeking****	**Collect Data* Location & Access****	**Reduce & Organize Data* Information Use****	**Display Data* Synthesis****	**Compile Conclusions/ More Questions* Evaluation****
Geography Source: Bednarz, S. W. and others. *Geography for life; national geography standards, 1994.* Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.	Standard 1 The World in Spatial Terms How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective p. 144	Standard 1 The World in Spatial Terms Use geographic tools and technologies to **pose and answer questions** about spatial distributions and patterns on Earth by being able to use maps to understand patterns of movement in space and time p. 145	Standard 1 The World in Spatial Terms Use maps and other geographic representations, tools, and technologies to **acquire,** process, and report **information** from a spatial perspective p. 144	Standard 1 The World in Spatial Terms Use maps and other geographic representations, tools, and technologies to **acquire,** process, and report **information** from a spatial perspective p. 144	Standard 1 The World in Spatial Terms Use maps and other geographic representations, tools, and technologies to acquire, **process,** and report **information** from a spatial perspective p. 144	Standard 1 The World in Spatial Terms Use maps and other geographic representations, tools, and technologies to acquire, process, and **report information** from a spatial perspective p. 144 Show spatial information on geographic representations by being able to construct diagrams or charts to display spatial information (e.g. construct a bar graph that compares the populations of the five largest cities in a U.S. state) p. 109	

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Geography Source: Bednarz, S. W. and others. *Geography for life; national geography standards, 1994.* Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.	Standard 6 Places and Regions How culture and experience influence people's perceptions of places and regions p. 117			Standard 6 Places and Regions Compare the different ways in which people view and relate to places and regions by being able to **conduct interviews to collect information** on how people of different age, sex, or ethnicity view the same place or region,... then organize the information by subject (e.g. medical facilities) type of interviewee (e.g. Africa-American male teenager) and response p. 117	Standard 6 Places and Regions Compare the different ways in which people view and relate to places and regions by being able to conduct interviews to collect information on how people of different age, sex, or ethnicity view the same place or region,... then **organize the information** by subject (e.g. medical facilities) type of interviewee (e.g. Africa-American male teenager) and response p. 117		

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Geography Source: Bednarz, S. W. and others. *Geography for life; national geography standards, 1994.* Washington, DC: Department of Education, National Endowment for the Humanities, and the National Geographic Society.	Standard 18 The Uses of Geography how to apply geography to interpret the present and plan for the future p. 181		Standard 18 The Uses of Geography Integrate multiple points of view to analyze and evaluate contemporary geography issues by being able to **do research on both the student's own point of view and other people's perceptions** of a controversial social, economic, political, or environmental issue that has a geographic dimension and then write a report on that subject, which includes an informed judgment as to what solution should be implemented. p. 181-2		Standard 18 The Uses of Geography Integrate multiple points of view to analyze and evaluate contemporary geography issues by being able to do research on both the student's own point of view and other people's perceptions of a controversial social, economic, political, or environmental issue that has a geographic dimension and then **write a report** on that subject, which includes an informed judgment as to what solution should be implemented. p. 181-2	Standard 18 The Uses of Geography Integrate multiple points of view to analyze and evaluate contemporary geography issues by being able to do research on both the student's own point of view and other people's perceptions of a controversial social, economic, political, or environmental issue that has a geographic dimension and then write a report on that subject, which **includes an informed judgment as to what solution should be implemented.** p. 181-2	

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* Information Problem-Solving**	**Generate Questions* Task Definition****	**Determine Feasibility* Information Seeking****	**Collect Data* Location & Access****	**Reduce & Organize Data* Information Use****	**Display Data* Synthesis****	**Compile Conclusions/ More Questions* Evaluation****
Health Source: Joint Committee on National Health Education Standards. (1995). *National health education standards.* American Cancer Society.	Standard 2: Students will demonstrate the ability to access valid health information and health--promoting products and services. **Rationale** Critical thinking involves the ability to identify valid health-promoting services and products. Applying skills of information analysis, organization, comparison, synthesis, and evaluation to health issues provides a foundation for individuals to move toward becoming health literate and responsible, productive citizens. p. 18		Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services. Grades K-4 1. **identify characteristics of valid health information** and health-promoting products and services. p. 18 Grades 5-8 1. **Analyze the validity of health information,** products and services. Grades 9-11 1. **evaluate the validity of health information,** products and services. p. 18	Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services. Grades K-4 2. demonstrate the ability to **locate resources** from home, school and community that provide valid health information. p. 18 Grades 9-11 2. demonstrate the ability to **evaluate resources** from home, school and community that provide valid health information. p. 18	Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services. Grades 5-8 2. demonstrate the ability to **utilize resources** from home, school and community that provide valid health information. p. 18	Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services. Grades K-4 3. explain how media influences the selection of health information, products and services. p. 18 Grades 5-8 3. analyze how media influences the selection of health information, products and services. p. 18	

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* **Information Problem-Solving****	**Generate Questions*** **Task Definition****	**Determine Feasibility*** **Information Seeking****	**Collect Data*** **Location & Access****	**Reduce & Organize Data*** **Information Use****	**Display Data*** **Synthesis****	**Compile Conclusions/ More Questions*** **Evaluation****
Health Source: Joint Committee on National Health Education Standards. (1995). *National health education standards.* American Cancer Society.	Standard 4. Students will analyze the influence of culture, media, technology, and other factors on health. **Rationale** Health is influenced by a variety of factors that co-exist within society. These include the cultural context as well as media and technology. A critical thinker and problem solver is able to analyze, evaluate, and interpret the influence of these factors on health... p. 20					Standard 4. Students will analyze the influence of culture, media, technology, and other factors on health. Grades K-4 2. explain how media influences thoughts, feelings and health behaviors 3. describe ways technology can influence personal health p. 20 Grades 5-8 2. analyze how messages from media and other sources influence health behaviors. 3. analyze the influence of technology p. 20	Standard 4. Students will analyze the influence of culture, media, technology, and other factors on health. Grades 9-11 2. evaluate the effect of media and other factors on personal, family and community health 3. evaluate the impact of technology on personal, family, and community health. p. 20

National Content Standards Compared to Minnesota's Inquiry Process and Information Problem Solving "Big6"

	Inquiry in general* Information Problem-Solving**	**Generate Questions* Task Definition****	**Determine Feasibility* Information Seeking****	**Collect Data* Location & Access****	**Reduce & Organize Data* Information Use****	**Display Data* Synthesis****	**Compile Conclusions/ More Questions* Evaluation****
History Source: National Center for History in the Schools. (1996). *National standards for history.* Los Angeles, CA: Author.	Historical thinking skills that enable students to evaluate evidence; develop comparative and causal analyses, interpret the historical record; and construct sound historical arguments and perspectives on which informed decisions in contemporary life can be based. p. 2	Standard 3. The student engages in historical analysis and interpretation. A. Formulate questions to focus their inquiry and analysis. p. 21		Standard 2 The student comprehends a variety of historical sources. F. Draw upon data in historical maps...p. 19 G. Draw upon the visual and mathematical data presented in graphs, including charts, tables, pie and bar graphs, " etc.p. 19 H. Draw upon the visual data presented in photographs, paintings, cartoons, and architectural drawings in order to clarify, illustrate or elaborate upon information presented in the historical narrative. p. 19-20			

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History Source: National Center for History in the Schools. (1996). *National standards for history.* Los Angeles, CA: Author.		Standard 4: The student conducts historical research. A. Formulate historical questions:... p. 22		Standard 4: The student conducts historical research. B. Obtain historical data from a variety of sources, including: library and museum collections, historic sites, historical photos, journals, diaries, ...and so on. p. 22	Standard 4: The student conducts historical research. C. Interrogate historical data by ...testing the data source for its credibility, authority and authenticity; and detecting and evaluating bias, distortion, and propaganda by omission, suppression or invention of facts. p. 22	Standard 4: The student conducts historical research. D. Marshal needed information of the time and place in order to construct a story, explanation, or historical narrative. p. 22	

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Mathematics Source: National Council of Teachers of Mathematics. (1989) *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.	Evaluation Standard 5: Problem Solving The assessment of students' ability to use mathematics in solving problems should provide evidence that they can— • formulate problems; • apply a variety of strategies to solve problems; • solve problems; • verify and interpret results; • generalize solutions. p. 209	• formulate problems;	• apply a variety of strategies to solve problems;	• apply a variety of strategies to solve problems;	• solve problems;	• verify and interpret results;	• generalize solutions.

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Mathematics Source: National Council of Teachers of Mathematics. (1989) *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.	Standard 11 Statistics and Probability In grades K-4 - ...students can— • collect, organize and describe data; • construct, read and interpret displays of data; • formulate and solve problems that involve collecting and analyzing data; • explore concepts of chance.p. 54	Standard 11 Statistics and Probability • **formulate** and solve **problems that involve collecting and analyzing data**; p. 54		Standard 11 Statistics and Probability • **collect**, organize and describe **data**; p. 54	Standard 11 Statistics and Probability • collect, **organize and describe data**; p. 54	Standard 11 Statistics and Probability • construct, read and interpret displays of data; p. 54	Standard 11 Statistics and Probability • formulate and **solve problems that involve collecting and analyzing data**; p. 54
	In grades 5-8, ...students can– • collect, organize and describe data; • construct, read and interpret tables, charts, and graphs • make inferences and convincing arguments that are based on data analysis• evaluate argu-ments that are based on data analysis • ...	More advanced standards are in grades 9-12. More advanced standards are in grades 9-12.		• systematically **collect**, organize and describe **data**; **p. 105** More advanced standards are in grades 9-12.	• systematically collect, **organize and describe data**; p. 105 More advanced standards are in grades 9-12.	• construct, read and interpret tables, charts, and graphs p. 105 More advanced standards are in grades 9-12.	• make inferences and convincing arguments that are based on data analysis • evaluate arguments that are based on data analysis p. 105 More advanced standards are in grades 9-12.

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Physical Education Source: National Association for Sport & Physical Education. (1995) *Moving into the future: national physical education standards: a guide to content and assessment.* St. Louis, MO: Mosby.	Student projects provide for a range of strategies and results including the following: the application of the processes of data collection, goal setting, planning, analysis, decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.)" p. 109	Student projects...: the application of the processes of data collection, **goal setting,** planning, analysis, decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.) p. 109	Student projects...: the application of the processes of data collection, goal setting, **planning,** analysis, decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.) p. 109	Student projects...: **the application of the processes of data collection,** goal setting, planning, analysis, decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,... **multiple resources,**(etc.) p. 109	Student projects...: the application of the processes of data collection, goal setting, planning, **analysis,** decision making, problem-solving; development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.) p. 109	Student projects...: the application of the processes of data collection, goal setting, planning, analysis, **decision making, problem-solving;** development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,...multiple resources,...(etc.) p. 109	Student projects...: the application of the processes of data collection, goal setting, planning, analysis, decision making, problem-solving; **development and application of skill and knowledge to real-life situations to solve problems or create 'new' interventions to reach personal goals,**...multiple resources,...(etc.) p.109

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Science Source: *National science education standards.* (1996). Washington, DC: National Academy Press.	Content Standard A: Science as Inquiry In grades K-4, all students should develop the following abilities necessary to do scientific inquiry: • ask a question about objects, organisms, and events in the environment • plan and conduct a simple investigation • employ simple equipment and tools to gather data and extend the senses • use data to construct a reasonable explanation • communicate investigations and explanations p. 122	Content Standard A: Science as Inquiry (K-4 • ask a question about objects, organisms, and events in the environment p. 122	Content Standard A: Science as Inquiry (K-4) • plan and conduct a simple investigation p. 122	Content Standard A: Science as Inquiry (K-4) • employ simple equipment and tools to gather data and extend the senses p. 122	Content Standard A: Science as Inquiry (K-4) • use data to construct a reasonable explanation p. 122	Content Standard A: Science as Inquiry (K-4) • use data to construct a reasonable explanation p. 122	Content Standard A: Science as Inquiry (K-4) • communicate investigations and explanations p.122

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Science Source: *National science education standards.* (1996). Washington, DC: National Academy Press.	In grades 5-8, all students should develop the following abilities necessary to do scientific inquiry: • identify questions that can be answered through scientific investigations • design and conduct a scientific investigation • use appropriate tools and techniques to gather analyze and interpret data • develop descriptions, explanations, predictions, and models using evidence • think critically and logically to make the relationships between evidence and explanations p. 145	Content Standard A: Science as Inquiry (5-8) • identify questions that can be answered through scientific investigations p. 145	Content Standard A: Science as Inquiry (5-8) • design and conduct a scientific investigation p. 145	Content Standard A: Science as Inquiry (5-8) • use appropriate tools and techniques to **gather,** analyze and interpret data (Students should be able to **access, gather, store,** retrieve, and organize data, **using hardware and software designed for these purposes)** p. 145	Content Standard A: Science as Inquiry (5-8) • use appropriate tools and techniques to gather **analyze and interpret data** (Students should be able to access, gather, store, **retrieve, and organize data, using hardware and software designed for these purposes)** p. 145	Content Standard A: Science as Inquiry (5-8) • develop descriptions, explanations, predictions, and models using evidence p. 145	Content Standard A: Science as Inquiry (5-8) think critically and logically to make the relationships between evidence and explanations p. 145

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Science Source: *National science education standards.* (1996). Washington, DC: National Academy Press.	In grades 9-12, all students should develop the following abilities necessary to do scientific inquiry: • identify questions and concepts that guide scientific investigations • design and conduct a scientific investigation • use technology and mathematics to improve investigations and communications • formulate and revise scientific explanations and models using logic and evidence • recognize and analyze alternative explanations and models • communicate and defend a scientific argument p. 175-76	Content Standard A: Science as Inquiry (9-12) • identify questions and concepts that guide scientific investigations (Students should formulate a testable hypothesis and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment) p. 175	Content Standard A: Science as Inquiry (9-12) • design and conduct scientific investigations p. 175	Content Standard A: Science as Inquiry (9-12) • use technology and mathematics to improve investigations and communications p. 175	Content Standard A: Science as Inquiry (9-12) • formulate and revise scientific explanations and models using logic and evidence p. 175	Content Standard A: Science as Inquiry (9-12) • communicate and defend a scientific argument p. 176	Content Standard A: Science as Inquiry (9-12) • recognize and analyze alternative explanations and models (...although there may be several plausible explanations, they do not all have equal weight. Students should be able to use scientific criteria to find the preferred explanations) p. 175

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Social Studies Source: National Council of the Social Studies. (1994). *Expectations of excellence: curriculum standards for social studies.* Washington, DC: Author.	Essential Skills for Social Studies: Acquiring Information: A. Reading Skills, B. Study Skills, C. Reference & Information-Search Skills D. Technical Skills Unique to Electronic Devices p. 148		Acquiring Information B. Study Skills 1. Find Information e.g. evaluate sources of information—print, visual, electronic p. 148	Acquiring Information B. Study Skills 1. Find Information e.g. use key words... to find information C. Reference and Information-Search Skills 1. The Library e.g. use computer catalog service 2. Special Reference e.g. government publications 3. Maps, Globes, Graphics e.g. detect bias in visual material 4. Community Resources e.g. conduct interviews D. Technical Skills Unique to Electronic Devices e.g. access information through networks p. 148	Acquiring Information B. Study Skills 2. Arrange Information in Usable Forms e.g. take notes, listen for information p. 148	Acquiring Information B. Study Skills 2. Arrange Information in Usable Forms e.g. write reports and research papers p. 148	

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Social Studies Source: National Council of the Social Studies. (1994). *Expectations of excellence: curriculum standards for social studies.* Washington, DC: Author.	Organizing and Using Information: A. Thinking Skills p. 149				Organizing and Using Information: A. Thinking Skills 1. Classify Information e.g. group data in categories according to appropriate criteria 2. Interpret Information e.g. note cause and effect relationships 3. Analyze Information e.g. detect bias in data presented in various forms: graphics, tabular, visual, print 6. Evaluate Information e.g. test the validity of the information, using such criteria as source, objectivity, technical correctness, currency p. 149	Organizing and Using Information: A. Thinking Skills 4. Summarize Information e.g. Restate major ideas of a complex topic in concise form 5. Synthesize Information e.g. Present visually (chart, graph, diagram, model, etc.). information extracted from print p. 149	

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Social Studies Source: National Council of the Social Studies. (1994). *Expectations of excellence: curriculum standards for social studies.* Washington, DC: Author.	I. Culture h. explain and apply ideas, theories, and modes of inquiry drawn from anthropology and sociology in the examination of persistent issues and social problems. p. 33 V. Individuals, Groups, & Institutions h. explain and apply ideas and modes of inquiry drawn from behavioral science and social theory in the examination of persistent issues and social problems. p. 38			III. People, Places & Environments c. use appropriate resources, data sources, and geographic tools such as aerial photographs satellite images, geographic information systems (GIS), map projections, and cartography to generate, manipulate, and interpret information such as atlases, data bases, grid systems, charts, graphs, and maps; p. 35	II. Time, Continuity & Change d. systematically employ processes of critical historical inquiry to reconstruct and reinterpret the past, such as using a variety of sources and checking their credibility, validating and weighing evidence for claims, and searching for causality; p. 34		

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Social Studies Source: National Council of the Social Studies. (1994). *Expectations of excellence: curriculum standards for social studies.* Washington, DC: Author.	VI. Power, Authority & Governance h. explain and apply ideas, theories, and modes of inquiry drawn from political science to the examination of persistent issues and social problems; p. 39			X. Civic Ideals & Practices c. **locate, access,** analyze, organize, synthesize, evaluate, and apply information about selected public issues—identifying, describing and evaluating multiple points of view; p. 45	X. Civic Ideals & Practices c. locate, access, **analyze,** organize, synthesize, evaluate, and apply information about selected public issues—identifying, describing and evaluating multiple points of view; p. 45	X. Civic Ideals & Practices c. locate, access, analyze, **organize, synthesize,** evaluate, and apply information about selected public issues—identifying, describing and evaluating multiple points of view; p. 45	X. Civic Ideals & Practices c. locate, access, analyze, organize, synthesize, **evaluate, and apply information** about selected public issues—identifying, describing and evaluating multiple points of view; p. 45

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Technology Education Source: Hutchinson, J. and Karsnitz, J. (1994). *Design and problem solving in technology.* Albany, NY: Delmar.	The design loop is: 1. Identifying problems and opportunities: Analyzing real-world situations 2. Framing a design brief: Problem clarification and specification 3. Research and investigation: Information gathering 4. Generation of alternative solutions: Generating ideas and generating solutions 5. Choosing the best solution 6. Developmental work 7. Modeling and prototyping: Construction 8. Testing and evaluating p. 19	1. Identifying problems and opportunities: Analyzing real-world situations p. 19	2. Framing a design brief: Problem clarification and specification p. 19	3. Research and investigation: Information gathering p. 19	4. Generation of alternative solutions: Generating ideas and generating solutions p. 19	5. Choosing the best solution 6. Developmental work 7. Modeling and prototyping: Construction p. 19	8. Testing and evaluating p. 19

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Technology Education Source: Todd, R. D. and others. (1995). *Introduction to design and technology.* Cincinnati, OH: Thomson Learning Tools.	The Design Loop has the following steps: Identify and define the problem—Investigating new opportunities. Develop the design brief—Clarifying the results you want to achieve. Explore possible alternatives—Searching for solutions and information Accumulate and assess the alternatives—Developing and choosing the best solution Try out the best solution—Experimenting and developing solutions, models, and prototypes Evaluate the results—Testing the solution and assessing the process. p. 17	Identify and define the problem—Investigating new opportunities. p. 17	Develop the design brief—Clarifying the results you want to achieve. p. 17	Explore possible alternatives—Searching for solutions and information p. 17	Accumulate and assess the alternatives—Developing and choosing the best solution p. 17	Try out the best solution—Experimenting and developing solutions, models, and prototypes p. 17	Evaluate the results—Testing the solution and assessing the process. p. 17

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Arts	X	X	X	X	X	X	X
Civics	X	X			X	X	X
English	X	X	X	X	X	X	X
Foreign Languages	X			X	X	X	
Geography	X	X	X	X	X	X	X
Health	X		X	X	X	X	X
History	X	X		X	X	X	
Mathematics	X	X	X	X	X	X	X
Physical Education	X	X	X	X	X	X	X
Science	X	X	X	X	X	X	X
Social Studies	X		X	X	X	X	X
Technology Education	X	X	X	X	X	X	X

This chart shows which content standards publications have statements or standards that relate to each of the steps in Minnesota's Inquiry Process and Eisenberg and Berkowitz's Information Problem-Solving process. All of the content areas have statements that refer to Inquiry in general. In addition, they all require students to demonstrate that they can organize and display data. All of the content areas, except Civics, require students to collect data. Steps that are missing in three of the content areas are generating questions and determining feasibility and/or determining which sources best fit their information needs. Two content areas did not include the step of compiling conclusion.

Do Scribes Learn? Copying and Information Use

Joy McGregor
Denise Streitenberger

Abstract

In two qualitative field studies, the behaviors of eleventh grade students were observed as they used information to write research papers. In 1993, a naturalistic case study took place in a high school in Alberta, Canada. In 1996, a second study in Texas examined in depth particular findings of the Alberta study. Phase One analysis in both cases consisted of comparing students' final papers with the original sources of information. Because of teacher intervention in the form of emphasis on proper citation, the second group was very conscious of avoiding plagiarism and the need to cite appropriately. The first group received little direction in citation or plagiarism. Although both groups demonstrated a fairly high rate of copying directly from the source, the second group used a pattern non-existent in the first group's papers. They included many passages that were taken directly from the sources, parenthetically referenced, but not enclosed in quotation marks. The authors suggest students who copy may not be making sense of the information they use. Instructional interventions based on format and rules may have some effect on limiting the amount of blatant copying by students in the research paper process, but may have little effect on improving the level of understanding that students construct through the process.

Introduction

Picture a class of eleventh graders, gathering information in the library for a research paper assignment. Some students stand at the reference shelves, reading titles on spines. At some point they pull a book off the shelf and open it, perhaps to the front or the back or to a specific page. They either restore the book to the shelf or take it to their table. A few students linger around the microfiche readers, waiting their turn. Some of them search through the drawers of microfiche. At the computer catalog, several students punch the keys and stare at the screen. Several students are lined up to use the photocopier. Other students are seated at the tables, writing. Most of those students have a book open in front of them, and they look back and forth from the book to their paper as they write. A group of students at one table talk to each other. Members of another group stand waiting to talk to the teacher, who is discussing something with one student. The room is busy and not very quiet. What are these students doing? Most of them are probably locating books and articles that contain information. Some are starting to gather the information from the books, the microfiche, or the computers.

Two days after the above scenario, the scene has changed somewhat. The noise level is down and movement is less. Most students are now sitting at the tables, writing. The teacher is sitting alone at another table, reading and writing. Talk occurs at some tables, while at others it's quiet. Fewer students are wandering around, standing at bookshelves, or lined up in various places. Those who are moving around seem to complete their task quickly and return to a table where they might make a comment to another student or else sit down quietly and begin writing. At this point, most students have moved from locating sources to gathering information from those sources.

Now we look at the next week. The students are back in the classroom. They have cards filled with notes and lists surrounding them, some scattered, some sorted into piles. A few students are writing, others are shuffling cards. Still others are talking to each other and some are waving their hands in the air, trying to get the teacher's attention. The teacher is moving around the classroom, talking to students whose hands were raised, occasionally being interrupted by someone who comes to stand beside her, occasionally stopping to talk to the whole class. The noise level is high. Now the students are trying to use the information they have gathered to write their research papers.

We have described the external, observable elements of a class of eleventh grade students writing research papers, which is a common assignment in high schools across North America. But is there more going on than meets the eye? What is happening in terms of learning, the goal one would expect of a project such as this? The potential for learning on many levels exists in a research project. Opportunity for learning in both content and skill or inquiry areas exists (Resnick 1989). Learning through information-gathering could provide skill development of several kinds. Students could learn to generate appropriate questions for research. Students could acquire locational skills by examining a variety of information sources and formats. As they become familiar with these sources and determine how to use them, they could develop analytical skills that could apply to using other, less familiar sources. Encountering information expressed in different ways and not always in agreement should help them learn to deal with ambiguity. They should learn to evaluate the credibility and usefulness of the information. They could be learning to organize their thinking as they sort and categorize the information. As they think about multiple pieces of information and determine their relationships to one another, they should be learning how to synthesize that information. We also hope that as they gather and use information, they are developing an understanding of their topic (Bloom 1956).

Creating a written product such as a research paper has the potential of providing further learning. Students should gain experience in solving problems based on personal goals set and revised as they move through the process. Research by Flower and Hayes (1980) shows that better writers "develop flexible goals to guide their writing processes . . . , rich enough to work from and argue about, but cheap enough to throw away" (Hull 1989, 107). Teachers expect students to learn to synthesize ideas into a coherent product, organize information into a logical sequence, and communicate the synthesis cogently. Throughout a project such as this, as students seek meaning in the text they encounter and make sense of the information, they should be constructing their own understanding of the subject matter. The ideas they read and their own prior knowledge should meet in a "construction zone--a magic place where minds meet, where things are not the same to all who see them, where meanings are fluid, and where one person's construal may preempt another's" (White 1989, ix). Their perceptual and conceptual changes would vary from one person to another, but the project should provide opportunity for change and growth to take place.

But do students really gain these understandings as they work on research projects? What difference do interventions by adults make in facilitating this learning? Are there interventions that inhibit learning or that teach something other than what they are designed to teach?

Design and Implementation

Two naturalistic research studies observed forty-five eleventh grade students carrying out research paper assignments. One was the project described in the introduction, which took place in an English class in Texas in 1996. That project grew out of an earlier study in 1993 in which students in Alberta, Canada wrote English and Social Studies research papers (McGregor 1994). In the original study, a model of student thinking during research paper writing was generated. One element of the model showed an orientation toward process or product. An apparent connection between strong product orientation and plagiarism was observed, but further research was needed to investigate this link. The Texas study was designed to explore student information use in general and also to probe the possibilities of the link between product orientation and plagiarism.

Students

The samples were purposefully selected to observe eleventh grade students writing research papers as part of their normal educational experience. No effort was made to control either situation in any way, but the research sites were chosen to provide as much similarity as possible. Both schools have a good reputation academically and are located in small, middle class communities, just outside major urban areas. The student participants, though, demonstrated a range of ability levels. The Canadian students were International Baccalaureate (IB) students and the American students comprised a more heterogeneous group. The Alberta sample was selected to provide the richest data possible regarding student thinking, with the assumption that IB students might be able to describe their thinking most easily. The heterogeneous Texas sample was selected to observe a wider range of behaviors.

In the Alberta study, three teachers and two classes were involved, with one class observed in two subjects--English and Social Studies-- and the other class only in English. The Texas study involved one English class of 21 students and one teacher.

In the Alberta study, students were observed and interviewed during the information collection phase of their papers, and audiotaped think-aloud protocols of their paper-writing phase were analyzed. In the Texas study, students were observed and interviewed throughout the information collection and writing phases. In both cases, research logs, notes, and final drafts of the research papers were collected and analyzed and sources of information were examined. The first study was conducted by one researcher and the second by two.

Adult Intervention

Although adult intervention was not the focus or the purpose of either study, it would have been impossible to conduct the studies without observing these interventions throughout. It is important to provide some description of this area, because in both studies, these interventions emerged as important to the resulting student research papers and to the learning of the students. The form of adult intervention was different with each class, as would be expected, since four different teachers and two librarians were involved.

In the Alberta study, two English teachers, one Social Studies teacher, and one librarian provided various forms of assistance to students. The English teachers introduced the assignment in class, providing a brief handout describing the format of the product and a grading rubric, followed by a discussion of format and grading. One teacher spent considerably longer discussing format than the other. Elements of form that were emphasized in both cases were:

- number of sources of information required
- formal report style
- length
- extra elements required, such as a table of contents.

Both English classes were instructed not to copy from the sources of information and to use their own words instead. Topic selection in both cases took place in the classroom by drawing teacher-designed topics from a hat, the same set of topics in each class. Once the classes arrived in the library, both teachers answered questions when asked, but usually stayed separate from the students otherwise. One teacher wandered around occasionally, monitoring students' efforts somewhat. The other rarely did.

The Social Studies teacher gave an introductory assignment that required use of the books they would need for the research papers, in order to familiarize the students with the collection in the general topic area. He introduced the assignment in class and gave out a brief handout with grading scheme and formatting instructions which were:

- length
- number of sources
- citation style

He provided the question students were to answer, which required critical analysis of the information located and a decision based on that information. Class discussion covered their process for coming to a conclusion about the topic. This teacher discussed ideas with students when asked, monitoring their progress throughout.

The librarian in the original study spent a few minutes at the beginning of the first period in the library with each class, introducing the materials to the students as a group, explaining the value and use of some of the most important resources. She was available to answer questions when students directed them her way, which happened occasionally. Most of the books that they would need were preselected and assembled on a book truck when students arrived in the library, although they still went to the shelves to use reference sets and a few other sources. Since the writing occurred at home, no teacher or librarian interaction took place once the classes left the library.

In the Texas study, a great deal more instruction took place on writing research papers. It is likely that the difference in the composition of the classes (International Baccalaureate and heterogeneous) meant the students had had different prior experience with research papers. The teacher introduced the topic in the Texas classroom in great detail, teaching the steps in writing research papers and demonstrating the major resources they would be likely to use. She gave students extensive handouts, explaining specific requirements, notetaking, draft writing, formatting, quoting, citing sources, editing, and grading. Prior to going to the library, she discussed the specific assignment requirements and notetaking in detail, but primarily in terms of format, including:

- what to put on note cards
- number of note cards
- how to write bibliography cards
- number of bibliography cards
- deadlines for turning cards in
- content of thesis statement
- content of outline
- number of paragraphs
- number of sources to be cited
- number of parenthetical references in each section of paper
- number and length of quotes
- number of sources to be included in bibliography

Students selected their topic from a list of ninety-six possible topics or could select a topic not listed. No more than two students could select the same topic.

When the students arrived in the library to begin their information collection, they had already been introduced to the most important sources, and so the librarian simply discussed expectations for behavior in the library. The librarian was not involved with this assignment at any other time, except for one instance where she reprimanded a student for inappropriate behavior.

Teacher intervention in the library during information gathering dealt with how to do note cards and bibliography cards, seldom on what information is important, how to evaluate the information, or how to choose the best sources when there are many.

Following information gathering, the Texas students spent class time writing their papers. Teacher intervention at this point was extensive. She demonstrated how to write a thesis statement and how to write an outline, providing examples of these and instructing students to use her examples as format models, plugging the appropriate details pertinent to their topic into the right place in the sentence or phrase. She constantly reminded them to cite sources appropriately. She provided editing instructions and practice. Emphasis was primarily on the format of each of these elements. She helped individuals with each of these tasks (sometimes actually doing the task for the student), approved their thesis statements and outlines, and answered questions constantly.

In both studies, teachers and librarians assumed that students knew how to use information without assistance. They provided intervention on locational and formatting problems, but seldom on how to use the information once it was located. No one discussed how to select appropriate information from sources, how to evaluate information for usefulness, how to reconcile conflicting information from various sources, or why quoting other writers might be useful or appropriate. No data were gathered to indicate whether or not this discussion had taken place on previous occasions. In the first study, it is possible that International Baccalaureate students were expected to be capable of carrying out that task independently. In the second study, the emphasis on format of each element--notecards, bibliography cards, citations, quotes--dominated instruction, and, though not specifically stated in the written objectives of the project, that format and the elimination of plagiarism were clearly the focus of the assignment. One written objective was "To use efficient and scholarly research skills" which could be assumed to include that focus on format.

Discussion of Observations

Since it was possible for observation to extend through the entire library research project, including the writing phase, and since teacher intervention was more extensive throughout the Texas study, this paper will deal with observations primarily from that study, with some comparison between cases. Although both studies incorporated both quantitative and qualitative data analysis, this discussion is based chiefly on the quantitative analysis of the Texas study.

A finding from the original study, an apparent connection between a process/product orientation of a particular student and the way that student used information, was investigated further in the second study. All students in the Alberta study demonstrated an orientation toward the product--the research paper. Students were concerned about making their product fit the mold they envisioned, based on their prior experience and the instructions for the assignment. Those students who demonstrated little or no awareness of processes such as seeking meaning, making sense, or learning tended to exhibit a strong desire to make the final product "look good" or "sound right." These same students tended to copy a great deal from the original sources of information, rather than paraphrase the information or synthesize the ideas. On the other hand, the students who demonstrated involvement in processes of seeking meaning, making sense, or learning did not copy from their sources. They synthesized, summarized, and paraphrased the information. The apparent relationship between the product/process orientation and the tendency to copy provoked questions related to whether this was a chance connection and, if not, the nature of the relationship.

Students in the Alberta study received very little direction related to copying or plagiarism, other than an early admonition not to do it. In the Texas study, however, the teacher constantly reminded students not to plagiarize and instructed them on how to quote and cite properly. She required them to copy all information word for word from the original sources to their note cards, which they handed in with their final papers and which she said she would check for plagiarism. It was impossible to know whether this element was strongly emphasized due to the teacher's awareness of the researchers' interest in why students copy or because it was an integral part of this teacher's instruction. The reason was irrelevant, since the outcome in either case was that students received instruction and coaching in avoiding copying and citing according to an accepted style. This element provided an unexpected opportunity to analyze the effects of such instruction.

The amount of copying was determined in both studies by comparing the students' final papers with the original sources listed in their bibliographies. Categories of copying were devised and described in the first study (see Appendix A) and applied again to the second study. Category labels were assigned to portions of the paper that were copied word for word (the category was labeled E), copied very closely but with minor word or tense changes (labeled D), or copied with more word changes but still following the original sentence and paragraph patterns (labeled C). The amount of copying in each category was then determined and calculated as a percentage of the total paper. When students copied by changing some of the words but leaving the sentence and/or paragraph patterns intact (category C), it was assumed that they were attempting to paraphrase, albeit ineffectively. Blatant copying with little or no change (D or E) was interpreted as more indicative of an inability or an unwillingness to avoid plagiarism. Each paper was assigned a level, determined by the percentage of D or E type of copying. Papers ranged from Type 1, which contained no copying, to Type 5, which contained 50% copying or more. Table 1 compares the amount of copying at the D and E levels in each of the English classes in the two studies. Only English classes are compared, since the topics in both cases required reporting historical information. The decision-making requirement in the Social Studies paper may have resulted in different thinking processes and information use strategies, rendering it less comparable to the English papers.

Table 1
Comparison of Copying Scores at D and E Level, English 1993 and 1996

	English 1993 (Alberta study) % D and E	English 1996 (Texas study) %D and E
Type 1 (no copying)	31.3	50
Type 2 (less than 15%)	21.9	40
Type 3 (15-29%)	15.6	0
Type 4 (30-49%)	12.5	5
Type 5 (50% or more)	18.8	5

Table 1 shows that blatant copying (D and E) was somewhat less in the Texas study, probably due to the many reminders to avoid plagiarism and the emphasis placed on proper citation. Only 10% of the papers in the Texas study were Type 4 and 5 (30% or more of the paper was information copied almost word for word). In the Alberta study, 31% of the papers were Type 4 and 5. It would appear that the teacher intervention emphasizing avoiding plagiarism was effective with many students, since the amount of blatant copying was considerably less.

Analysis of Errors

Traditionally, cognitive developmentalists have delved into thought processes by observing errors in written and spoken language. Through observing these behavioral errors, a means of identifying patterns in the development of cognition emerges (Piaget 1964; Ferreiro and Teberosky 1974). Based on this tradition, errors in the students' attempts to cite and paraphrase were analyzed in order to identify possible patterns in their thinking.

Citation Errors

An interesting phenomenon emerged in the 1996 research papers that did not exist in the 1993 papers. A large number of papers contained a variation of the D and E categories of copying, but they were followed by parenthetical references, seemingly making them legitimate citations. Analysis showed that these portions of the paper were incorrectly cited in a number of different ways. Many of these portions included exact copies of the original text, cited, but without quotation marks. Others were very similar to the original, again cited, but without quotation marks. To be correctly cited, these portions should either have been exactly the same as the original and enclosed in quotation marks, or else paraphrased so that they were quite different, including sentence patterning, with the source of the idea cited. Instead of one of those alternatives, they were a hybrid of the two--a token attempt or no attempt at paraphrasing followed by a parenthetical reference, since students were very aware of the need to cite. They omitted quotation marks from the exact quotes in these portions, perhaps because they had already reached their limit of exact quotes allowed in the paper (no more than two long quotes).

Other citational errors were found in these portions with parenthetical references and no quotation marks. Citing the wrong source entirely was a common error. Some of these examples were located in another source listed in the bibliography and some were not found in any of the sources. Others were a combination of two other sources, with a third source cited. Some wrong source citations were in the midst of a series of citations from the actual source. It appeared that these students were concerned that they had cited this source too often and changed one citation in the middle to give the appearance of using more information sources than they actually used.

Another citation error was citing the correct source incorrectly. Errors of this type included citations to the wrong page, combining two sources and citing one or the other but not both, or citing only a portion of a quote but including more than that portion.

Errors were found within the quotations themselves. Errors included misspelling from the original source to the note card, then reproducing the same misspelling in the paper. In some cases, words were completely changed from the source to the paper. Some examples of this error were these: "dissection" became "direction," "absurd" became "observed," "guilt" became "quilt," "hilly" became "chilly," "best" became "worst," and "envy" became "entry."

Paraphrasing Errors

Both the 1993 and the 1996 students had difficulty with the concept of paraphrasing. Paraphrasing was not defined for the Alberta students in 1993, while the teacher in Texas in 1996 defined paraphrasing as expressing " the thoughts of someone else in your own words"(teacher handout). The Texas students were informed that their own writing is distinctive and individual. This implies that sentence patterns, too, would be distinctive and not a replica of the patterns in the original source. Poorly paraphrased segments, labeled as category C on the Copying Scale, were considered to be copied, since they followed the original sentence patterns closely, with some word and phrase changes. These portions seemed to represent an effort to comply with expectations at some level, although not at the level of effectively expressing an idea in their own words.

Students in the Texas study received direct instruction in paraphrasing in the form of a handout. Guidelines included statements such as:

- a paraphrase often includes your interpretation of complicated phrases and ideas
- never use a word of which you do not know the exact meaning when paraphrasing
- make sure you understand the ideas in the passage
- look up any unfamiliar words or phrases
- turn the card over and try to write from memory the main idea that is expressed on the card.
  (Handout given to students in 1996 class)

Reproducing the original author's sentence patterns, but replacing some words with synonyms and shifting the position of some phrases, probably indicates that the student was still looking at the original sentence. This reproduction does not show understanding of complicated phrases and ideas, let alone interpreting them. Sometimes the word replacement involved simplification of the original word, which might indicate that the student understood that word. Often, however, the replacement word was just as complicated as the original, and the synonyms were thesaurus-like, not necessarily appropriate for the particular context.

Skillful paraphrasing (category B) requires making sense of what is read. An attempt to paraphrase, but poorly done (C), indicates that students tried to carry out a requirement of not plagiarizing, but might not have attempted to make sense of the whole idea or understood it well enough to express it their own way. Citing (DE*), but barely attempting to paraphrase, takes even less thought and indicates simply carrying out a requirement or possibly an expectation that paraphrasing wouldn't be assessed. Logically incorporating that original text into the paper may require some making sense of the idea, just as effective incorporation of a properly cited quotation requires sense-making, but very often the incorporation of such text was not effectively done. Connections and transitions from one sentence to the next were missing. A change from one source to another was very obvious, because different voices were used.

What Do The Errors Mean?

What can we learn about student thinking from these errors or error patterns? Can we make assumptions about what these errors might indicate? We cannot make absolute judgments and arrive at specific findings, but several interesting issues emerge, following a logical progression. What do the errors suggest about (1) whether students look for meaning in information, (2) whether they use that meaning to make sense, and (3) whether they construct their own understanding of that information?

Although some of these errors were likely typographical (hilly to chilly, guilt to quilt), others seem to indicate that meaning was not important. At the moment the word was changed, whether in transcribing from source to note card or from note card to paper, the student likely was not trying to incorporate the idea into his or her existing mental model of the topic. When the replacement word was a different part of speech or unrelated in meaning, there could be little making sense going on, either during notetaking or writing.

Almost half the Texas students put little effort into really making sense of their topic. They showed a lot of product-orientation, but in a more defined and directed sense than students in the first study. Their attention to citation of ideas, whether accurate or inaccurate, indicated that they were more aware of the format of that product element than the first group, probably because the interventions from the teacher emphasized this point so heavily. This was part of the teacher's goal--to make them aware of the need to cite words and ideas of others. She was successful in making them aware of that. Less than 5% of the aggregate total of their papers was copied without citation, compared with 22% in the Alberta study. She was less successful in getting them to cite accurately.

Seeking meaning leads to making sense, which in turn leads to constructing one's own understanding. Resnick states that "to learn about something, to come to understand it, is, in current cognitive science parlance, to construct a mental model" (1989, 4). Vosniadou and Brewer describe levels of change in developing mental models:

> Accretion refers to change that occurs through the gradual accumulation of factual information within existing schemata. Tuning describes the evolutionary changes in the categories used for interpreting information .... Restructuring refers to changes in knowledge that involve the creation of new structures. (1987, 52)

An immature, inaccurate mental model can become more accurate and more sophisticated as understanding is constructed.

A prime concern coming out of the Texas study was how much students actually changed their mental models of either the topic they were studying or the procedure for using information from outside sources--how much they constructed their own understanding of their topic or the procedure. They spent a great deal of time and effort simply scribing--copying or nearly copying words and sentences from an original source to a note card and then from a note card to a paper. Some of this scribing led to legitimate copying, in the form of quoting appropriately from the source. Most of it led to inappropriate copying or plagiarism. The activity of scribing seems unlikely to lead to accretion, tuning, or restructuring. Perhaps minimal accretion occurs through copying words from one place to another, but the permanence of any factual information accumulated that way is suspect. Did new understanding really develop? Did the mental model really change? Since the students were not available for interviewing after some time had lapsed, it is impossible to know to what degree they actually constructed a personal understanding of their topic. If the intent of the assignment was strictly procedural--to teach students how to cite--even the mental model of that procedure was not well constructed, as indicated by the number and kinds of citational errors.

Students copied extensively, sometimes legitimately as in quoting from the original source and attempting to cite appropriately (according to an accepted style, as defined by the teacher), and sometimes unacceptably, by plagiarizing with no attempt to cite. Table 2 indicates the number of students in the Texas study that copied in those two ways combined. The kind of copying in this table is different from the kind of copying referred to in Table 1, since Table 2 combines the appropriate quoting and citing with the inappropriate plagiarism. Any attempt to cite, whether it followed the prescribed style or not, was consider an attempt to cite, while lack of any indication of a source for the copied information was considered plagiarized. Since both required copying word for word, or very close to it, from the original source, both were seen as involving a scribing type of task.

Table 2
Level of Copying (Both Appropriate and Unacceptable)
(Texas study)

% of total paper copied	% of students
15-29%	10
30-49%	5
50-74%	70
75-100%	15

One of the goals of the assignment was to teach students to quote and cite appropriately. This fact must be considered in all discussion of the scribing activity. The teacher probably did not intend, however, for students to simply string together a series of quotes and call it a research paper. Table 2 shows that 70% of the Texas students copied, either legitimately by quoting or illegitimately by plagiarizing, between 50 and 75% of their papers and another 15% copied, in the same manner, more than 75% of their papers. These numbers seem to indicate minimal constructing of students' own understandings. Based on the way in which scribed portions of the papers were incorporated into the context of the surrounding text, it is likely that the mental models of both the subject matter and the procedural knowledge of appropriate citation were inadequately developed.

Speculations and Further Research

In the Alberta study, teacher intervention relating generally to use of information, and specifically to avoiding plagiarism, was minimal. Based on the high degree of copying demonstrated by those students, the questions arose of why students copy and whether or not that tendency is related in any way to the level of process awareness. Are students who demonstrate processes of seeking meaning and making sense less likely to plagiarize? By extension, if there is a relationship between a lack of process orientation and the tendency to copy, it would seem that teacher intervention could make a difference to the situation. But what kind of intervention would make a difference? Because of the 1996 teacher's emphasis on avoiding plagiarism, the opportunity to explore a particular kind of intervention emerged. It appears, based on the primarily quantitative analysis of data from that study, that emphasizing avoiding plagiarism and appropriate citation does not eliminate the behavior, but modifies it to some extent. Whether the modification is beneficial to student learning is debatable. If this was the first time that a teacher had intervened in this way, perhaps students made a beginning in a long, slow process of developing an awareness of appropriate ways to use other writers' ideas. Further qualitative analysis of these data and of other data gathered through interviews and research logs in the Texas study may yield other observations.

In neither the Alberta nor the Texas study were librarians greatly involved in the library research projects. For the benefit of all information users, perhaps librarians could initiate improved communication and collaboration designed to enhance learning. Modification of long-standing educational practices could lead to students' constructing a better model of both subject matter and information use. As suggested by Pitts in a 1994 study of high school learners/information users, "careful, but not intrusive, monitoring of individual student progress throughout the unit will be necessary if the teachers involved are to provide appropriate expert support for the new learning and to identify problems and provide mediation" (Pitts 1994, 384).

New questions launch further exploration. How do teachers intervene effectively to increase learning of both topic and procedure beyond simple compliance with a requirement? How can librarians make a difference? If librarians and teachers work more closely together to mediate in the library research experience, can student learning improve? Could increased or different collaboration between teachers and librarians have an impact on information use? Do different assignment demands lead to different behaviors? What motivates students to copy? Further research related to these questions can expand our understanding of the construction of meaning and the development of mental models of information use.

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APPENDIX A

Categories of Copying

A No copying.

B Paraphrasing, doesn't closely resemble original.

C Paraphrasing, can easily recognize original pattern of sentences and paragraphs, but many words have been changed.

D Copying, with phrases rearranged, omitted, some words added. Occasional synonyms used.

E Copied word for word for the most part. May involve some omissions, slight rearranging, minimal changing of tenses, minimal use of synonyms.

Examples of Copying

Category C:

As it appeared in the original source:

> "The urban workers of France were a tiny minority compared with the nation's great masses of peasants. Yet their influence during the Revolution would be tremendous--out of all proportion to their numbers" (Banfield, Susan. 1989. *The rights of man, the reign of terror: The story of the French revolution*. New York: Lippincott, 16).

As it appeared in a student's paper:

> "The urban workers of France also formed part of the third Estate. They were a tiny minority alongside the nation's great mass of peasants, yet they had tremendous influence during the Revolution."

Category D:

As it appeared in the original source:

> "The Scottish witches associated, so it was believed, with evil spirits which appeared in the form of animals. Macbeth's witches also associate with evil spirits which appear in the form of cats and toads" (Winstanley, Lilian. 1922. *Macbeth, King Lear and contemporary history*. London: Cambridge University Press, 114).

As it appeared in a student's paper:

> "Witches were believed to associated (sic) with evil spirits which appeared in the form of animals. Macbeth's witches associate with evil spirits in the form of cats and toads."

Category E:

As it appeared in the original source:

"In the church a number of staging conventions evolved that were to remain in use throughout the Middle Ages. The acting space was divided into two parts: the *mansions* and the *platea*. The mansions (also called stations, seats, or *sedes*) were simple scenic devices for indicating the location of incidents. For example, a throne might be used to suggest the residence of Pilate. Each place was represented by a different mansion, and all remained in view throughout the play.

Since the action could not be performed in the limited space provided by the typical mansion, the actors used as much of the adjacent floor area as they needed. Often the same space was used in many different scenes. This generalized acting area was called the *platea* (or sometimes the place or playne). Thus, a series of mansions was arranged around a neutral playing space, and the performers moved from one mansion to another as the action demanded" (Brockett, Oscar. 1974. *The theatre: An introduction.* 3rd ed. New York: Holt, Rinehart, & Winston, 119).

As it appeared in a student's paper:

"A number of staging conventions evolved in the church that were to remain in use throughout the Middle Ages. The acting space was divided into two parts: the mansions and the platea. The mansions (also called stations, seats, or sedes) were simple scenic devices for indicating the location of incidents. For example, to suggest the residence of Pilate a throne might be used. Each place was represented by a different mansion and all remained in view throughout the play. However, since the action could not be performed in the limited space provided by the typical mansions, the actors used as much of the adjacent floor as they needed. Often the same space was used in many different scenes and this generalized area was called the platea (or sometimes the place or playne). This series of mansions arranged around a neutral playing space provided the 'stage' and the performers moved from one mansion to another as the action demanded."

Author Biographical Notes

Joy H. McGregor, Ph. D.

Currently an assistant professor in the School of Library and Information Studies at Texas Woman's University, I teach courses such as The School Library Media Center, Librarians as Instructional Partners, and Research Methods. Continuing analysis of the qualitative data gathered for the above Texas study triggers new questions related to students, information use, process/product orientation, and intervention by experts.

The papers for Treasure Mountain 6 were at the same time stimulating and frustrating: stimulating because of the range of ideas and frustrating because I wanted to attend all the concurrent presentations to talk about these ideas. The focus on the nature of our intervention is relatively new in our field. Intervention itself isn't new, but we are starting to realize how little we really know about effects of various forms of intervention. So much research is needed on so many elements raised by TM6 papers. So many new questions are raised by the research going on currently. We made a beginning at TM6. We all have a responsibility to find out more for the sake of the students.

Denise C. Streitenberger, Ed.D.

As a doctoral candidate with a minor in library science, I spent a year as research assistant on the above Texas project. After graduation from Texas Woman's University with a Doctorate in Education, I am currently writing and exploring research possibilities in the use of information with young children. Treasure Mountain Research Retreat #6 was my maiden voyage into the stimulating pool of fellow researchers and practitioners. The collaboration of these two groups is essential for the growth of our field. The concerns shared by practitioners have steered my future research agenda. The openness at TM6 offered me the opportunity to share research and get feedback without risking my entire reputation.

Media, Visual, Technology and Information: A Comparison of Literacies

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Abstract

Educators in today's schools are developing new curricula for technology literacy, information literacy, media literacy or visual literacy. Often one of these literacies is intended to reflect the concepts of all but in reality does that happen? This paper explores each of these literacies based on a framework that reflects common stages or threads. Information process models, media and visual curricula, and a technology literacy whitepaper are compared with the results showing similarities, differences, and omissions. The final conclusions are discussed in relation to the new information literacy standards developed by AASL and AECT.

Introduction

As the proliferation of information has emerged at an exponential rate in this Information Age, information literacy is now an important skill for students to master along with their ability to read, write and calculate. (Lazarus & Lipper, 1994, p. 7). *Information Power's* (AASL & AECT, 1988) mission statement, "the library media program is to ensure that students and staff are effective users of ideas and information" (p. 1) underscores the significance of this fourth basic skill.

If information literacy is equivalent to other basic skills in school curricula, then there must be a common understanding of the skills and knowledge required of students. Information skills, media and visual literacy, and technology literacy represent the most important frameworks related to the broader information literacy discussion. Educators have used these terms interchangeably or created new combinations. For example, Lazarus and Lipper (1994) in their report on *America's Children and the Information Superhighway*, used the phrase "information technology skills" (p. 7). Many state departments of education are creating technology and information literacy curricula or frameworks but there are no consistent guidelines which apply to this development process. The confusion weakens and diminishes the importance of information literacy and frustrates those charged with teaching children the skills and knowledge they require to be independent consumers of information. The purpose of this paper is to compare and synthesize the various models, definitions, and frameworks represented in media, visual, technology and information literacies.

The major concepts or stages from the models and frameworks are represented on two charts (figure 1 and 2) at the end of this paper. A common set of stages is presented in the left column on each chart, using language that seems to represent patterns reflected in the concepts, steps or stages of the information skills models. These stages provide a framework for representing the various models on the charts and the synthesis discussion at the end of this paper. Entering the stages or processes into the charts required some abbreviation of original wording and shifting of concepts to fit the common set of stages.

Media and Visual Literacy

Media literacy has many definitions and often includes perspectives on visual literacy. Pungente (1996) believes "the media literate person is one who has an informed and critical understanding of the nature, the techniques and the impact of the mass media as well as the ability to create media products." (p. 9)

Considine and Haley (1992) would separate media and visual literacy. They believe students who are media literate "should be confident and competent consumers and creators of media messages" . . . [with the ability to] "comprehend the media and to analyze and evaluate media messages" . . . [and] "design and produce media products that successfully communicate information and feelings." (p. 12)

Dede Sinclair (1996) provides one example of a framework for media literacy in the following concepts that reflect the Ontario (Canada) Media Literacy curriculum which is included in their Language Arts Curriculum. The major concepts include:

1. All media are a construction, achieved by a process of selection of images, codes and conventions.
2. Audiences develop their own meanings from media texts.
3. Creators of mass media are subject to commercial implications and reflect many influences.
4. All media contain values and ideology. (p. 27)

Considine and Haley (1992) believe media and visual literacy are different and represent that perspective in the following frameworks, beginning with media literacy:

> *Content Analysis.* Students should be able to analyze and evaluate media messages.
>
> *Form and Style.* Students should be able to recognize the way the form and style of the message affects it and us.
>
> *Influence and Audiences.* In studying the media students should look internally at the form and content of the image, but they must also look externally and think about the impact media messages and media technologies have on society as a whole and on audiences and user groups.
>
> *Sources and Structure.* . . . Examining the organization and ownership of the media in an attempt to understand where the messages come from and how the source might affect the message.
>
> *Production.* . . . [Provide students] the opportunity to transfer what they have learned to the practical design and production of their own media projects (p. 13-14).

The visual literacy framework suggested by Considine and Haley (1992) includes "the ability to comprehend and create information that is carried and conveyed through imagery." (p. 14) They would enhance this definition to include: "comprehending and reading images, . . . creating images, . . . [and] thinking visually" (p. 15).

The Ontario Media Literacy (Sinclair, 1996) curriculum seems to collapse media and visual literacy into one set of concepts while Considine and Haley present a framework that views these two literacies separately. Considine and Haley (1992) suggest students must be able to "analyze and evaluate" (p. 13) media while the Ontario Media Literacy curriculum proposes that students must be able to develop their own meaning from media messages. The notion of "comprehending and reading images" (Considine and Haley, 1992, p. 15) seems significant because it suggests there is a corollary between comprehending and decoding text and the application of this same process as it relates to images. The importance of recognizing biases of media messages is represented in both frameworks. Considine and Haley believe production is important and suggest students should construct original products.

Technology Literacy

Computer literacy has slowly evolved into technology literacy over the past twenty years. Initially, educators defined computer literacy as the ability to be effective users of hardware and problem-solvers with a programming language, typically Basic. As more software became available, the emphasis shifted to the ability to use application programs (e.g. word processors, databases, spreadsheets, and graphics programs). Typically this type of curriculum was delivered through computer literacy courses which included keyboarding and some programming.

Today, a growing number of educators define technology literacy in a broader sense, to include a knowledge of application programs, designing multimedia productions, and using the Internet. The focus also includes a career component and ethical issues that relate to the use of technology. Many schools have computer lab facilities which are used for regular courses and short term curriculum projects where the total class has a need to use computers. Educators recognize the need to integrate technology skills and knowledge across the curriculum. A search of the Web generated examples of technology literacy curricula developed by school districts and state departments of education. Some of these curricula are written using the scope and sequence model, with a primary focus on separate computer courses. Other curricula have developed performance outcomes or broad goals as a framework for an integrated approach.

A recent International Society for Technology in Education (ISTE) White Paper developed by Thomas and Knezek (1997) seems to represent the major concepts included in the technology literacy curricula developed by school districts and state departments of education.

Technology literacy is more than the understanding of current uses of technology, and it is more than the ability to use common technology-based tools according to a given prescription for achieving some specific outcome. Technology literacy involves:

- demystifying technology through conceptual understandings of the underlying science and mathematics principles,
- operational competence with modern technology systems,
- the ability to evaluate and use a variety of common technology applications,
- an awareness of technology-related careers and of factors critical to success in those careers, and
- understanding of and sensitivity to society issues related to technology. (p. 2)

It is interesting to note that the above framework for technology literacy includes a focus on careers and ethical issues which were also included in media and visual literacy frameworks represented by the Ontario Media Literacy curriculum (Sinclair, 1996) and Considine and Haley (1992).

Information Literacy

The American Library Association (1989) provides a formal definition of information literacy as, "a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." (p. 1)

Paula Montgomery (1987) adds to this conceptualization of information the notion to "appreciate information given a wide range of resources in varied formats" to the ALA definition (p. 32). Lazarus and Lipper (1994) broaden this scope with the perspective that information literacy is a basic skill along with "reading, writing, and calculating skills" and include a focus on "developing critical thinking, problem-solving and lifelong learning skills" (p. 32).

School library media specialists have taught library skills from a content perspective for many years but Kuhlthau (1995) suggests this approach has changed to a focus on information skills as a process. She believes:

> Library skills prepare students to locate materials in a library. Information skills prepare students to learn in an information-rich environment. The concept of information literacy encompasses lifelong learning and the application of information skills to everyday living.
> (p. 2)

Information skills today are viewed as a holistic process that provide an important foundation for the constructivist perspective which puts students into a problem solving mode requiring them to gather and use information to construct new knowledge (Kuhlthau, 1993). This knowledge construction process requires reflection time for learners.

Curriculum integration and collaborative planning between teachers and library media specialists are also important for successful implementation of information skills. Stripling and Pitts (1988) suggest "library media specialists must have as their goal the weaving of a 'research strand' into every area of the curriculum" (p. 154). The California Media and Library Educators Association (1994) believes that teachers and library media specialists "have a symbiotic relationship" and "teaching students a research process isolated from the curriculum is useless" (p. 26).

Information Skills Models

A variety of frameworks and models have been developed to implement the mission of information literacy in school curricula. Each of these models reflects a holistic process approach and the model developers believe the process should be taught within the context of the curriculum rather than as a separate, isolated program.

Kuhlthau's (1989) Model of the Search Process is unique among the models discussed in this paper because the six stages have been developed through longitudinal qualitative research studies which provide a student perspective of the information seeking process. A significant element of this model focuses on the affective domain; feelings, thoughts, and actions of searchers. Kuhlthau's research, and her model, provides a perspective on the way searchers are thinking and feeling at various stages of the process which enables teachers and library media specialists to better understand their actions. As searchers proceed through stages of the search process, they experience feelings of "uncertainty; optimism; confusion, frustration, and doubt; clarity; sense of direction and confidence; to relief" (p. 20). At the same time, searchers' thoughts range from "ambiguity" to "specificity," with increased interest occurring when they reach "focus formulation" and "information collection" (p. 20). Concurrently, searchers' actions suggest they begin their task initiation by "seeking relevant information" and, as they near search closure, they are "seeking pertinent information" (p. 20).

The Research Process Model developed by Barbara Stripling and Judy Pitts (1988) is a ten-step process. The model includes research process steps and reflection points which "direct students to evaluate the work they have just completed, . . . [and] revise or re-perform the previous research-process step until they are able to answer the reflection-point questions satisfactorily" (p. 20). These reflection points add an important dimension and it was not possible to include them on the composite chart (Figure 1), so the full model is shown below.

Step 1: Choose a broad topic.
Step 2: Get an overview of the topic.
Step 3: Narrow the topic.
    Reflection Point: Is my topic a good one?
Step 4: Develop a thesis or statement of purpose.

Reflection Point: Does my thesis or statement of purpose represent an effective, overall concept for my research?

Step 5: Formulate questions to guide research.

Reflection Point: Do the questions provide a foundation for my research?

Step 6: Plan for research and production.

Reflection Point: Is the research / production plan workable?

Step 7: Find / Analyze / Evaluate sources.

Reflection Point: Are my sources usable and adequate?

Step 8: Evaluate evidence / Take notes / Compile bibliography.

Reflection Point: Is my research complete?

Step 9: Establish conclusions / Organize information into an outline.

Reflection Point: Are my conclusions based on researched evidence? Does my outline logically organize conclusions and evidence?

Step 10: Create and present final product

Reflection Point: Is my paper / project satisfactory? (p. 20)

The ten-step process seems to suggest a linear progression and the reflection points encourage searchers to reflect on their process and consider revisiting that step. Each reflection point engages searchers in thinking about their research process which causes them to analyze and evaluate. Stripling and Pitts present their model in the larger context of a book with separate chapters on each step. A scope and sequence chart is included to cover grades seven through twelve.

The Big Six Skills developed by Eisenberg and Berkowitz (1990) is a "critical thinking hierarchy" (p. 11), which includes "hierarchical skills objectives reflecting the levels of Bloom's taxonomy" (Eisenberg and Berkowitz, 1988, p. 100). Eisenberg and Berkowitz (1990) suggest their model "can be applied to any information problem situation" (p. 10) and this notion is encouraged with the typical presentation of the *Big Six Skills* which focuses on the six major problem solving processes, that searchers find easy to remember and apply. Eisenberg and Berkowitz address the notion of linear versus nonlinear progression by suggesting that "information problem-solving is not always a linear, step-by-step process" (p. 12). Although the sequential presentation of the stages tends to appear linear, they believe branching is possible and is encouraged as students apply the evaluation phase of Bloom's taxonomy at each level of the *Big Six Skills.* Eisenberg and Berkowitz present their model in a book which includes a scope and sequence chart which would be useful for curriculum integration.

Pappas and Tepe (1995) have developed an information skills model that is graphical in format. The visual cues reinforce the concept that the information seeking process is nonlinear. The model was designed to "provide searchers with an array of information-gathering processes and suggests they may select those which best meet their needs and use them with a sequence which differs from one searcher to another" (p. 1). Within the graphic model, stages and strategies offer searchers choices and cues for reflection and evaluation. Appreciation is included as a stage, suggesting searchers might approach an information need motivated by curiosity developed in a literary or creative work. "For some students, this is the beginning of their information-seeking process, rather like dropping a pebble in the pond and watching the ripples become ever-increasing concentric circles" (Pappas, Geitgey, and Jefferson, 1996, p. 1--2). The model includes "search strategies [which] provide a common, consistent approach for students using electronic resources" (p. 1--4). These strategies include Browse, Hypertext, Hierarchical, and Analytical searching. The model has recently been retitled to *Pathways to Knowledge: Follett's Information Skills Model.* The Pathways model appears in three books along with a series of units developed by library media specialists and teachers to encourage curriculum integration and collaborative planning.

The *Information Problem-Solving Skills* model developed by the Wisconsin Educational Media Association and adopted by AASL is presented in an outline format which suggests a linear progression. Within each section of the model, a series of specific processes are written in outcome language which provides detail and an effective connection for curriculum integration. Various sections of the model focus on both print and electronic resources. For example, the Locating the Resources section indicates "the student will be able to access specific information within resources by using internal organizers (i.e. indexes, tables of contents, cross references) and electronic search strategies (i.e. keywords, Boolean logic)" (AASL & WEMA, 1993, p. 2).

Jamison McKenzie's (1996) model, the *Research Cycle*, seems more focused on one type of resource, the Internet, which makes it unique and interesting. The introduction to the model provides insight into McKenzie's rationale for developing the *Research Cycle* model. "We learned quickly that old approaches to student research were inadequate to meet the essential learning goals set by the district and were ill suited to the information rich environment we had created with our 1500 PC WAN" (p. 31). The *Research Cycle* focuses on student teams who collaboratively gather, use and evaluate information. The first stage of the *Research Cycle* is Questioning and McKenzie (1995) stresses the importance of developing essential questions. McKenzie believes "an essential question requires students to Evaluate (make a thoughtful choice between options with the choice based upon clearly stated criteria); Synthesize (invent a new or different version); or to Analyze (develop a thorough and complex understanding through skillful questioning)" p. 9. McKenzie (1996) suggests that Planning, the second stage of the Research Cycle, enables searching teams to be productive and efficient, as they gather information. Gathering includes structuring the findings when these are located. McKenzie believes "putting this task off until later is very dangerous when coping with INFO-GLUT" (p. 32). There is an element of the nonlinear to this model since McKenzie suggests "evaluation often requires several repetitions of the Cycle" (p. 32).

A Comparison of Media, Visual, Technology, and Information Literacies

Using the common stages, shown in the left column of Figures 1 and 2 as a framework for comparison, an examination of both charts indicates some interesting patterns, omissions, and differences between these literacies: media, visual, technology, and information. The Media/Visual Literacy and Technology Literacy frameworks do not contain concepts relevant to the stages of Defining Information Need and Planning. Both of these are curious omissions, particularly in the Media/Visual Literacy framework because this literacy includes a focus on production, which would suggest a need for prior planning. The Technology Literacy framework omits Communicating Information which may be an omission only because the framework language is very broad and general in scope. "The ability to evaluate and use a variety of common technology applications" (Thomas and Knezek, 1997, p. 2) might imply a variety of presentation, multimedia, and web design application software which could be considered Communicating Information. The Locating Information and Evaluation stages are also omitted from both of these literacy frameworks.

From the reverse perspective, there are concepts that appear on the Media/Visual and Technology frameworks which are omitted from the information skills models. The Technology Literacy framework includes "understanding of and sensitivity to society issues related to technology," (Thomas and Knezek, 1997, p. 2), which reflects a perspective not included on any of the information skills models. This suggests a focus on the ethical use of information which seems a significant issue, since using information is one element of the information literacy definition developed by the American Library Association.

The Technology Literacy framework includes "an awareness of technology-related careers and of factors critical to success in those careers" (p. 2). Given the current perspective on information skills, this concept does not seem to fit within an information seeking process. However, perhaps there is a place within the broader construct of information literacy.

The notion of appreciation appears in both the Media and Visual Literacy frameworks. For example, the Ontario Media Literacy curriculum includes "audiences develop their own meanings from media texts" (Sinclair, 1996, p. 27) and Considine and Haley's (1992) Media Literacy framework refers to "comprehending and reading images . . . [and] thinking visually" (p. 15). Two of the Information Skills Models include a focus on appreciation. The Pappas and Tepe (1995) model presents Appreciation/Enjoyment as a primary process which lists "viewing, listening, and reading" (p. 2). Eisenberg and Berkowitz (1990) include "Engage and extract information (e.g. read, hear, view) "within "Use of Information" (p. 24), and the authors chose to leave this concept under the Interpreting stage, since the notion of using information is located in that stage for other models. Neither of these perspectives seem to fully reflect the sense conveyed by Considine and Haley (1992) regarding the comprehension and reading of images. Montgomery's (1987) literacy definition suggests she believes to "appreciate information given a wide range of resources in varied formats" (p. 32) is important. This is an area where differing views seem apparent and clarification is important.

A comparison of the processes of the information skills models (Figure 1) suggests some interesting differences. Evaluation of product and process are included formally on three of the six models. Although Kuhlthau has no formal perspective relating to evaluation on her model she does address that issue in a recent article. "An essential part of the process approach to information skills is assessing the process as well as the product at the end of the project" (Kuhlthau, 1993, p. 13). Stripling and Pitts (1988) include a section on evaluation of product in their text discussion of the model.

The literature suggests that metacognition is an important element in critical thinking (Mancall, Aaron, and Walter, 1991), but the notion of reflection appears on only three models. Kuhlthau (1989) does not specifically refer to reflection but her focus on "thinking and feeling" (p. 20) infers this process. Stripling and Pitts (1988) use Reflection Points with many steps in their process to engage students in a questioning process prior to moving on to the next step. The Pappas and Tepe (1995) model encourages reflection within both the Interpretation and Communication processes.

Information access using electronic formats and the Internet suggest that a major change in the Locating Information stage might be appropriate. Electronic formats are nonlinear and interactive, and are constructed with design features that vary with most resources and across computer environments. Although the information skills process has shifted away from a focus on sources to process, library media specialists still teach students about the elements of a book. The new electronic formats deserve the same attention. Little focus on this area is apparent on the information skills models. The AASL & WEMA (1993) model includes a focus on electronic searching under Locating the Resources (p. 2). Pappas and Tepe have identified four search strategies under Searching for Relevant Information which have been developed to provide a parallel structure for electronic formats in the same way an index or table of contents enables information access in a book. The McKenzie (1996) Research Cycle was developed with a primary focus on the Internet and the Questioning, Planning, Sorting, Synthesizing, and Evaluating stages reflect the unique needs of information seeking in a technology environment. The Gathering stage of this model does not provide a specific focus on electronic formats or search strategies.

Another pattern that seems significant across all the frameworks and models relates to the notion of author and creator bias, which has become increasingly important in this age of information proliferation. For example, one of the major concepts on the Ontario Media Literacy curriculum (Sinclair (1996) states, "creators of mass media are subject to commercial implications and reflect many influences" (p. 2). The AASL & WEMA (1993) model includes "differentiate among fact, opinion, propaganda, point of view, and bias" (p. 3).

This synthesis illustrates the similarities and differences in the Media/Visual, Technology, and Information Skills frameworks and highlights some significant patterns. Although there are differences, there are many more commonalties. All the concepts or stages seem important so the question becomes, how might these frameworks be integrated to construct one perspective?

Conclusion

Common patterns which have emerged from these frameworks and models include:

- evaluation of the end product and process
- student engagement in the process of reflection
- literary appreciation is valued across all formats, text, visual, and sound societal issues influence information access and use
- information reflects the biases of those who produce it
- the information seeking process can be linear or nonlinear
- locating information in electronic formats requires different skills from those used with print formats.

There are two information literacy guidelines which reflect some of the concepts identified in the patterns above. The Colorado Model Information Literacy Guidelines (Colorado Department of Education, 1994) include "the student uses information and information technologies responsibly and ethically" (p. 1), which relates to one of the identified patterns. Another guideline, "the student learns independently; and participates effectively as a group member" (p. 1) is not included in the patterns identified from the frameworks discussed in this paper, but seems important.

The final document to be discussed in this paper is the draft of the AASL & AECT Information Literacy Standards for Student Learning. The learning outcomes reflect many of the patterns identified above. Those outcomes include:

I. The student who is information literate:
   Accesses information efficiently and effectively;
   Evaluates information critically and competently;
   Uses information effectively and creatively;

II. The student who is an independent learner is information literate and:
   Pursues information related to personal interests
   Appreciates and enjoys literature and other creative expressions of information
   Strives for excellence in information seeking and knowledge generation;

III. The student who contributes positively to the learning community and to society is information literate and:
   Recognizes the importance of information to a democratic society;
   Practices ethical behavior in regard to information and information technology
   Participates effectively in groups to pursue and generate information.

The authors believe this synthesis of media, visual, technology, and information literacies underscores significant patterns which are reflected in the new national guidelines. For example, the notion of appreciation across all formats and societal issues influencing information access and use are both addressed in these guidelines. "The student who is an independent learner . . . " (AASL & AECT, 1997, p. 1) also appears in the Colorado guidelines. Both the Colorado and AASL/AECT guidelines present a more global perspective on information literacy and seem to connect many of the disconnected pieces of Media/Visual Literacy, Technology Literacy, and Information Literacy. Although the original purpose of this paper was to provide an analysis and synthesis of literacies, the outcome suggests positive support for the new guidelines under development by AASL and AECT.

Betty Marcoux, Chair of the National Guidelines Vision Committee wrote an opening paragraph for the publication of the draft Information Literacy Standards for Student Learning which seems to provide an appropriate conclusion for this paper.

> Today's student lives and learns in a world that has been radically altered by the ready availability of vast stores of information in a variety of formats. The learning process and the information search process mirror each other: Students actively seek to construct meaning from the sources they encounter and to create products that shape and communicate that meaning effectively. Developing expertise in accessing, evaluating, and using information is in fact the authentic learning that modern education seeks to promote. (Marcoux, B. 1996, p. 1)

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Figure 1: Information Skills Models

	Kuhlthau *Search Process*	Stripling/Pitts *Research Process*	Eisenberg/ Berkowitz *Big Six Skills*	Pappas/Tepe *Pathways to Knowledge*	AASL/WEMA *Information Problem-solving*	McKenzie *Research Cycle*
STAGES **Appreciation**				Appreciation Reading, Listening, Viewing		
Defining Information Need	Task initiation Topic selection Prefocus exploration	Choose a broad topic Get an overview of the topic	Task definition	Presearch	Defining the need for information	Questioning
Planning	Focus formulation	Narrow the topic Develop a thesis and formulate questions Plan for research and production	Information seeking strategies	Search: Plan a search strategy	Initiating the search strategy	Planning
Locating Information	Information Collection	Find sources	Location and access	Search: Locate inf. providers; Resources; Search for relevant information	Locating the resources	Gathering
Interpreting/ Evaluating/ Constructing meaning	Search closure	Analyze/evaluate sources Evaluate evidence /take notes/ compile bibliog..	Use of information: Engage and extract information Synthesis:Organize information from multiple sources.	Interpretation: Assess usefulness; Reflect--personal meaning	Assessing and comprehending information; Interpreting the information	Sorting & Sifting Synthesizing Evaluating Determine quality of info.. before reporting
Communicating Information	Starting writing	Establish conclusions Org. into outline Create and present final product	Synthesis:Present information	Communication	Communicating the information	Reporting
Evaluating Search Process & End Product			Evaluation Judge the product and the process.	Evaluation of product and process.	Evaluating the product and process	
	(Kuhlthau, 1989, p. 20)	(Stripling & Pitts, 1988, p. 21)	(Eisenberg & Berkowitz, 1990, p. 24)	(Pappas & Tepe, 1997, p. 3)	(AASL & WEMA, 1993, p.2-3)	(McKenzie, 1996, p. 4-5)

Figure 2: Media/Visual and Technology Frameworks

STAGES	Media/Visual Literacy	Technology Literacy
Appreciation	All media are a construction, achieved by a process of selection of images, codes and conventions. (Sinclair) Comprehending and reading images; thinking visually. (Visual.Considine & Haley)	
Defining Information Need		
Locating Information		Demystifying technology through conceptual understandings of the underlying science and mathematics principles. Operational competence with modern technology systems. (Thoms & Knezek)
Interpreting/ Evaluating/ Constructing meaning	*Content Analysis.* Analyze and evaluate media messages. (Media. Considine & Haley) *Form and Style.* Recognize the way the form and style of the message affects it and us. (Media. Considine & Haley) *Sources and Structure.* Examine media to understand message source; how source might affect message. (Media. Considine & Haley) Comprehend information that is carried and conveyed through imagery. (Visual. Considine & Haley) Audiences develop their own meanings from media texts. (Sinclair) Creators of mass media are subject to commercial implications and reflect many influences. (Sinclair	Ability to evaluate and use a variety of common technology applications. Understanding of and sensitivity to society issues related to technology (Thomas & Knezek)
Communicating Information	Production. Provide students the opportunity to transfer what they have learned to the practical design and production of their own media projects. (Media. Considine & Haley) Create information that is carried and conveyed through images. (Visual. Considine & Haley)	
Evaluating Search Process and End Product		

Author Biographical Notes

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Marjorie Pappas is an associate professor and coordinator of the School Library Media Studies program at the University of Northern Iowa. She is the co-author of *Pathways to Knowledge™* (Follett Software Co., 1997), an information process model. Her scholarship interests have focused on common search strategies for print and electronic resources and information literacy. Marjorie also writes and speaks about curriculum integration of information skills and future visions of school library media programs. She writes for *School Library Media Activities Monthly*, *Technology Connections*, and co-authored *Searching Electronic Resources* (Linworth, 1996). She is also a writer and editorial consultant for various curriculum resources developed by Follett Software Company including the *Teaching Electronic Information Skills* series. She recently served as a content advisor and narrator for a series of student and professional development videos, *Know It All* (GPN, 1997), which focus on using an information seeking process for learner inquiry and information problem solving.

The Treasure Mountain 6 conference enabled me to grow in the area of information literacy. Julie Tallman's paper on the I-Search process gave me the impetus I needed to begin using I-Search with my students. I watched transformations in their understanding of learner engagement in information seeking as they participated in their own I-Search process.

Ann E. Tepe, M. Ed.

Ann Tepe is currently the Director of Curriculum Resource Development at the Follett Software Company. She has a BA from Marietta College and Masters in Education from Ohio University. She has been a teacher, school library media specialist, and district supervisor of libraries in several school districts in southern Ohio. In 1992 she became the Manager of the Educational Services Department of the Follett Software Company. In this position she provided the leadership and organizational skills needed to coordinate the efforts of over 70 training consultants and presenters scattered across the United States and Canada.

Ann co-authored *Pathways to Knowledge™* (Follett Software Co., 1997), an information process model, and led the development of the *Teaching Electronic Information Skills* series of resource guides. Ann's current responsibilities include the development of curriculum related products and workshops. She is a writer and national speaker on information literacy, information process models, curriculum integration of information skills, and search strategies for electronic resources.

I found the Treasure Mountain 6 conference especially rewarding for the small group discussions with leaders in the library media field. The formal and informal exchanges helped focus my thoughts in the area of information literacy and challenged me to continue to research, read and learn.

Information And Media Literacies: Towards A Common Core

Daniel Callison
Carol Tilley

Introduction

> When and under what circumstances does illiteracy become a social, indeed, a political "problem"? Answers to such questions will surely depend upon what we take "literacy" to be. Is it simply being able ritually to sign your name (as it was through so many years of American voting history), or should we require that a literate person not only decipher but comprehend what a piece of written text is about — grasp not simply what is *written (heard or viewed)* but what is *meant*? If we insist upon the latter criterion, then at what level of comprehension should we set the line? A commonsense, pragmatic approach to all issues of this order must obviously start with "It depends." (Bruner 1991)

In *Changing Our Minds*, Miles Myers (1996) describes the evolution of literacy in American society and education. For what he terms the new "translation/critical literacy," the primary literacy goal shifts from decontextualized parts (i.e. skills in isolation) to contextualized wholes (i.e. language experiences and communicative events.). Within this framework, learners are actively aware of their own efforts to fashion themselves as thinkers. Because they influence how we think about and solve our problems as well as communicate our answers, we must broaden our understanding of technologies and media.

Traditional print media, the news bite, the digital byte, and the pluralistic world of the Internet are all part of the communicative voice of this generation. Media merge to create multimedia where written, spoken, and visualized images, bring both improved clarity and new complexities to the communication process. Tables, charts, and icons appear more frequently to summarize data, express conclusions, and depict ideologies. Messages can be targeted at, tailored for, and delivered to a variety of audiences with increased ease, speed, and precision. While data are highly accessible and pressed on us constantly, the ability to successfully identify meaningful information, create meaningful information, and convey meaningful information becomes more challenging each day.

Various associations and societies as well as individual educators have attempted to create heuristics to help students meet these challenges. Often these come in the guise of literacy movements--media, information, computer, numeracy, visual-- which seek both to address the perceived short-comings of modern curricula and to create students who can negotiate the complex demands of the Information Age. By examining the two literacies, information literacy and media literacy, which seem to be most frequently prescribed, we hope to demonstrate that there is potential for dynamic interaction between which can lead to a richer application of both approaches, and ultimately, greater student success.

Media Literacy: Decoding for Reality

A common assumption of media literacy is that people are confronted with a barrage of messages from mass media including newspapers, magazines, movies, and television whether the they want the messages or not. Therefore, the lessons in media literacy often help the learner confront and live with these messages, not by turning them off, but by understanding the various intentions of the messages' producers. Through understanding the concepts and constructs of mass media, students are better able to determine what is real and what is important about the messages they receive. Ultimately, the power of the media over students may be lessened if they understand how to decode and evaluate these messages (Robinson, 1994).

According to the Ontario Ministry of Education (1989), a media literate person understands that:

All media are constructs. Although media appear to be a natural reflection of reality, they are rather a carefully constructed presentation of reality that reflectsan intended message or point of view.

All media construct reality. Media offer a message or point of view that becomes real to the audience if first-hand information is not available. The audience accepts this mediated information as reality and uses it to judge the world.

Audiences negotiate meaning in media. Everyone filters meaning from media through their own personal experiences, beliefs, and knowledge. Not everyone receives a mediated message in the same way; neither do all audiences receive the same message intended by the producer.

Media have commercial implications. The audience is the commodity being bought and sold. Content and format depend on whom is paying for contact with the audience. The audience is defined by demographics; the message, point of view, format, marketing are constructed to match the audience.

Media contain ideological and value messages. Media sell a lifestyle, value, or belief to audiences in a palatable or subtle manner which often seeks to reinforce the dominant culture. Audiences tend to be aware of messages most they disagree with them.

Media have social and political implications. Most Americans get information about their world from the media. Family life, leisure activities, consumer patterns, politics and government are all influenced by the media.

Media have unique aesthetic forms that are closely related to content. The format both influences and limits the content. Information is tailored to the format and presented differently in different forms of media.

The media literate person is in control of his or her media experiences because he understands the basic conventions of various media and enjoys their uses in a deliberately conscious manner. The media literate person understands the impact of music and special effects, for example, in heightening the drama of a television program or film; however, this recognition does not lessen his enjoyment of the action. Instead, it can prevent the viewer from being unduly credulous or becoming unnecessarily frightened.

Information Literacy: Problem Solving

Information literacy is the term being applied to the skills and attitudes required to master information problem-solving. As in media literacy, the learner must understand how to decode messages. The information literate student is able to describe the need for more information and use it to counter bias, counter stereotypes, and extend arguments. While the media literate student considers the same decoding tasks in relation to confronting the mass media, the information literate student seeks out and isolates the information problem regardless of setting--occupational, recreational, or intellectual (AASL, 1993).

The information literate student has the ability to access and use information which is necessary to succeed in school, work and personal life. Although similar to media literacy in skills of evaluating, comprehending, interpreting, and communicating information to convey a message with a purpose, the information literacy approach emphasizes problem identification and information search strategy skills. The information literate student successfully:

Defines the need for information. An information need is dependent on the person–his prior knowledge and experience–who has it as well as the context in which it is placed. Information needs can be established and clarified through questioning.

Initiates an information search strategy. Search strategies are most successful when the information seeker is able to identify and categorize concepts relevant to his information need. In addition, successful search strategies require the information seeker to understand the search system (e.g., indexes, online catalogs, Boolean logic) as well as to assess the potential value of retrieved information.

Knows a variety of access point for resources, data, and assistance in interpretation if necessary. The information seeker understands how to utilize a variety of information sources and agencies, as well as human resources in order to gain useful information. In addition, he understands the value of consulting with resource specialists and critical peers to reframe and refine questions and inquiries if necessary.

Assesses and comprehends the information. The information seeker identifies information important to his need and assesses its reliability, bias, authority, and intent. He also organizes new information in meaningful ways to determine where gaps may exist and to formulate the central question or thesis which can be addressed (Doyle, 1994).

The Critical Core

Central to both literacy movements is the set of intellectual abilities and skills students are expected to master. While the structure and discourse of this set may vary from one discipline to another, and even from one teacher's classroom to another, the key elements for student performance remain constant. Using Bloom's (1956) familiar *Taxonomy of Educational Objectives* as a framework, this set of skills and abilities can be described as follows:

Comprehension of messages, implicit and explicit understanding the core message (hypothesis, argument, idea) being communicated; understanding non-literal statements such as metaphor, symbolism, irony, exaggeration; interpreting various types of social data; dealing with conclusions, including predicting continuation of trends.

Application of general ideas, rules of procedures, or generalized methods. applying established norms to phenomena described in written, oral, and visual communication, both personal and formal; identifying factors which cause change and predicting the probable effect of the change.

Analysis of elements, relationships, and principles, recognizing unstated assumptions, distinguishing facts from hypotheses; examining the consistency of a hypothesis, argument, line of reasoning with given information and assumptions; recognizing form and pattern in literacy or artistic works as a means of understanding their meaning; recognizing the general techniques used in persuasive materials, such as advertising, propaganda, as well as social structures such as peer pressure and authority status.

Synthesis of communication, action, or relationships.selecting relevant parts and arrange or combine in order to form a meaningful whole, conclusion or message; organizing ideas, statements, and evidence to create a written, spoken, or visual message; diagnosing actions which constitute a plan; formulating an appropriate hypothesis or argument based upon analysis of factors involved and to modify such in light of new evidence.

Evaluation of internal evidence and external criteria. making judgments about the value of materials, methods, data, and various forms of evidence for given purposes; evaluating the accuracy of a communication from such evidence as logical reasoning, documented authority, consistency; referencing established external criteria of excellence; posing revisions in evaluation criteria when warranted. A worthwhile shorthand to condense these critical skills into more common language is as follows: Today's information and media literate citizen (student or teacher, in academic, social, or workforce situations) should be able to:

- pose worthwhile questions;
- evaluate the adequacy of an argument;
- recognize facts, inferences, and opinions and
- use each appropriately;

- deal with quandaries and ill-formed problems that have no fixed or unique solutions;
- give and receive criticism constructively;
- agree or disagree in degrees measured against the merits of the issue and audience;
- extend a line of thought beyond the range of first impressions; and
- articulate a complex position without adding to its complexity.

The Two Literacies: Working Together in the Classroom

While there are many commonalities shared between media and information literacies, one difference is the selection of the communicative channel, that is, how to present or convey information. Media literacy promoters tend to give preference to the visual and audio modes associated with television and motion pictures. Many educators who promote media literacy argue that the best way to understand media is to produce media. However, information literacy is not void of the application of media production skills and activities. Basic composition abilities are essential for scripting, editing, and expression of commands which lead to the production media programming. The usual communicative channel in information literacy has been the essay or written term paper with video production gaining some application in recent years. New technologies which include advancements in group software and in multimedia authoring are changing communicative channels dramatically and moving the presentation mode of these two literacy sets closer than they have been before.

More and more students are practicing information literacy presentation skills through collaborative efforts staged in electronic groupware composition exercises. Merits of evidence, for example, once shared can now be examined through electronic sharing of student essays while they are in the writing phases. Peer editing in these situations has started to reach new levels of critical analysis of evidence posed, sources quoted, data extracted and displayed. Argument and counter-argument can take place not only upon presentation of the final paper, video, or discussion panel, but it can also take place very effectively within the construction of the script, outline, persuasive paper, advertising plan, speech, or debate strategy formulation. Students can move forward in information analysis by demanding of themselves and their peers: "Do you have a second source to substantiate?", "Do you have a series of documents over time that can be linked together to support your conclusion?", "Can you validate this source through reasonable credentials of the author or the institution the author represents?"

In addition to electronic group composition processes, final products the standpoint of information and media literacy are beginning to look very similar because of the greater ease of multimedia authoring through platforms such as HyperStudio and the World Wide Web. Text, animation, graphics, tables, icons, voice, and video blur the differences between media literacy and information literacy as verbal, visual, and audio manipulations have become increasingly necessary to deliver the final product. Multimedia presentation design and production involves the same dynamics of group composition as participants may bring to the process unique talents and play different roles. But all students share in the process of critically selecting text, visuals, and sounds to construct the message. Audience analysis has gained some recent emphasis in both approaches as both composition groups and media production groups struggle with conveying a message that will be received. Analysis of the intended audience's information need and level of information reception (understandings and assumptions the audience brings to the text or visual) are critical skills regardless of communication format.

> **Scenario**: In the high school media center, students are preparing to produce a video news report set in a scene from the American Civil War. In order to solve the problems of set design, costumes, story content, language or dialect of the time, and frame of reference to events as chronologically correct as possible, these students have accessed a wide variety of resources. Some have searched the online catalog including a database of historical materials available through their state's historical society. They have examined a laserdisc of visual resources from the U. S. Library of Congress. Some have interviewed Civil War experts over electronic mail. Others have gathered from the local public library and from the nearby academic library through interlibrary loan replicated songs and speeches from the Civil War. The students will be evaluated not only on the organization and presentation of the media event, but on how well they substantiate the authenticity of the information used for the production.

Information and Media Literacies Together: Creating Critical Classrooms

In conclusion, we suggest that the most salient differences between media literacy and information literacy is the locus of intended influence.. **Media literacy** involves the learner reacting to an external factor, learning how to decode messages sent to influence his or her thinking, feelings, and actions. **Information literacy** involves the learner reacting to an internal need to know more, to take systematic steps and to employ strategies in order to find meaningful evidence or information to solve a personal, academic, and workplace problem.

While we have strained to identify different characteristics of these two literacy sets, the proposal here is that both need to be in operation across the language arts curriculum (as well as other curricular areas). The new Standards for the English Language Arts (NCTE 1996) call for instruction which makes productive use of the emerging literacy abilities that children bring to school. The combination of media and information literacies can drive the creation of new learning environments which demand the critical use of language in order to read, write, and communicate effectively to a variety of audiences. Within this framework, students can conduct research on issues and interests by generating ideas and questions, and by posing problems. Students can also gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience. Based on these combined literacies, students will also have increased opportunities to use a variety of technological and informational resources to gather and synthesize information and to create and communicate knowledge.

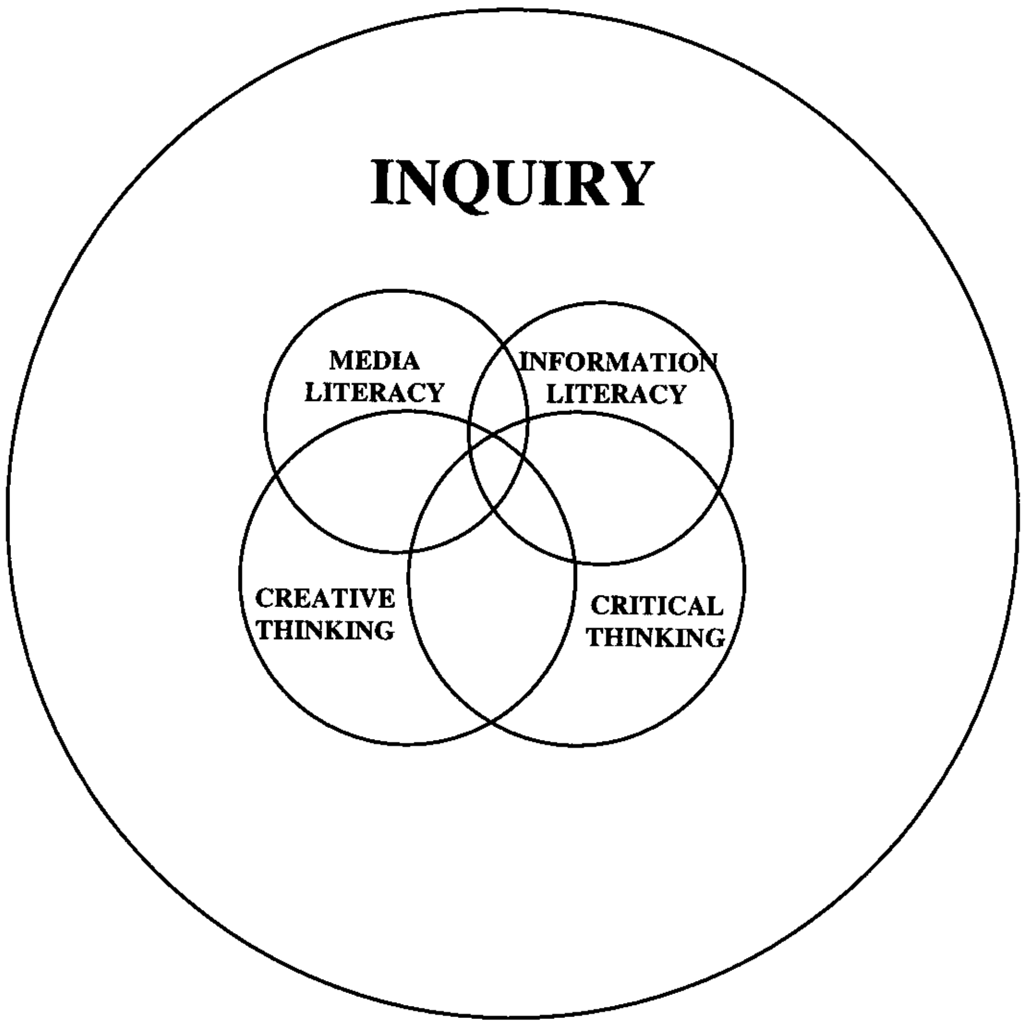

Diagram. The Relationships Among Inquiry, Media Literacy, Information Literacy, Creative Thinking, and Critical Thinking. Daniel Callison and Carol Tilley, Indiana University, Bloomington, IN. 1997.

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Author Biographical Notes

Carol Tilley is currently a doctoral student in the School of Library and Information Science at Indiana University, Bloomington. Her research interests include social cognition and information use, critical literacy, and the library connection to the reading-to-write process. Prior to beginning the doctoral program, she was a high school media specialist. E-mail correspondence concerning this article should be addressed to her at ctilley@indiana.edu.

Daniel Callison is an associate professor and Director of Library Science and School Media Education at Indiana University, Bloomington. In 1991, he launched a new graduate course, "Information Inquiry for School Teachers." The activities of the class place future and current school media specialists partnered with teachers in situations to experience information search and use processes. Inquiry methods, questioning, cognitive apprenticeship, modeling and facilitating, intervention strategies, interview skills, and authentic assessment are components of the class. The course is offered over the Virtual Indiana Classroom, providing interactive video conferencing among five campuses.

Students and Information Literacy Skills: An Urban Middle School Tale

Dian Walster

Abstract

Teaching information literacy skills to bilingual students presents a challenge to school library media specialists who may or may not be fluent in the languages of the students they serve. I explore how, as a novice in a bilingual middle school, I responded to the challenge of serving students who spoke and wrote in a language with which I was not familiar. From my experiences I suggest ideas for library media specialists to consider when teaching information literacy to bilingual and multilingual students. I also address concerns related to assessing bilingual students' information literacy competencies. This paper is the result of an ongoing ethnographic research study in an urban middle school. Participant observation, interviews and review of documentation were methods used to gather data for this research.

An Urban Middle School Tale

Michener Middle School is a neighborhood school that sits on a major downtown cross street in a regional urban center. I was familiar with Michener because I had lived in the neighborhood for two years before moving to a suburban part of town. However, I had never entered Michener nor did I actually know which building was Michener. There are churches and office buildings in the immediate vicinity. As I drove down Fourteenth Avenue the traffic was always fast having come directly off the Interstate and I watched the six lanes of one way traffic rather than the buildings. On my first day to report to Michener I missed the school and had to drive around a number of blocks and one way streets to arrive back at the school. The neighborhood was different than I had imagined. I had lived on one side of Fourteenth Avenue. Michener was on the other. My side was an odd combination of relatively expensive high rise apartment buildings, abandoned buildings, a high school and inexpensive public housing. The Michener side was designated an historic neighborhood (called the Michener Neighborhood) and was predominantly family dwellings and a neighborhood elementary school. This side looked nice. There were yards and flowers and kids walking to school. My side looked abandoned. People drove, particularly high school students. Yards, what few there were, were messy with no grass. The high rise apartments had landscaped grounds. A city park was almost always empty. Gangs and homeless adults made my side dangerous according to some.

I had been expecting a school that matched the side of the avenue I knew: dangerous and somewhat out of control. The school I entered was friendly, with a population of about 400 students and a comfortable feeling. It was a school neighborhood kids attended. It was also a school that was part of a twenty year old court mandated bussing system. I knew these two facts. I still did not know how those facts affected the library media center, the students or the curriculum. It was a long time before I started to understand the impacts.

As I approached the school, my first task was to find the main door. The original building facade and main door had been closed down. A side entrance next to the teacher's parking lot was being remodeled as the main entrance. Once inside I looked down a long corridor. There were still a few students in the halls but I guessed the rest were in classrooms. It was the first day of school for all three grades: sixth, seventh and eighth. Sixth graders were to be in their first period classes; seventh and eighth graders in their home rooms. This year every teacher in the school including the library media specialist, the computer teacher, and others had a home room class. My first introduction to the students of this school was as the library media specialist had them introduce themselves and talk about what they wanted to learn.

This was an eighth grade home room class of about 20 students. More than half the class had Latino surnames. Another fact I knew about this school was that there was a high percentage of students with Latino backgrounds. I also knew from one of my faculty colleagues that some students in the Michener neighborhood were monolingual Spanish speakers, some were bilingual Spanish/English speakers and some were monolingual English speakers. During their introductions many said there was nothing they wanted to learn. A couple of students were interested in computers. One student was interested in the saxophone, one in explosives and one in English (I interpreted this as an interest in literature at the time, but on reflection I am not certain of the meaning). They all had strong English speaking skills. I could not tell who among them might also speak Spanish. One student also might have been a speaker of an Asian language in addition to English. At the time I was not even thinking about what other languages they might speak.

I never wondered as I listened to these students what kind of language background they had. It was only later that the importance of language skills in relationship to information literacy skills became relevant to me. The importance of language in this school crept up on me over time. I believed for quite a while that this was a failure on my part as an ethnographic researcher to observe the language capabilities of the students. It was only during the end of my second year that I realized what had happened. The first year I was in the school the school district instigated a new bilingual program at the middle school level for sixth grade students only. This program included monolingual Spanish speakers in addition to gifted and talented monolingual and bilingual Spanish speakers. It was the gifted and talented bilingual students who used the library media center more during my first year there.

In my second year both the sixth and seventh grade had monolingual and bilingual Spanish speaking students. That year there were no students identified at the sixth grade level as gifted and talented bilingual. However, the pattern of bringing the bilingual classes into the library had been established. In addition, outside funding had provided many new Spanish language books and reference materials. Monolingual Spanish speaking students had both reason and resources for using the library media center. It was during this second year that the impact of the Spanish speaking students became apparent to me. I had not missed something. It was an overall change that was occurring in the school as I was doing my observations. The impact that had crept up on me was also being felt by others in the school.

One day I was in the library media center. I asked a group of young women if I could help them find an animal for their ecology project. I received an answer that I could not translate. It was completely in Spanish, spoken very rapidly and coming from at least two members of the group of four young women. I heard giggling as it became apparent that I did not understand. One of the young women asked me in Spanish if I understood Spanish. I answered, "Un poco." "A little." That was about as much of my one year of high school Spanish as I remembered. I said perhaps if they spoke more slowly I would be able to understand. They slowed down marginally but they also changed what they had been saying. That much I could tell. What they were saying was still out of my limited vocabulary. The giggling turned to tittering and finally to laughing. I still did not know what they were saying, was fairly certain they were saying something that was either vaguely vulgar or a joke at my expense and was a loss about what to do. No matter how slowly they spoke I would not be able to understand them. If they chose to pretend they did not understand me I had no way to know the extent of their language skills because by now I knew many of the students were truly monolingual Spanish speakers. I left the table feeling uncomfortable, unhelpful and extremely thoughtful about the role of library media specialists in bilingual settings.

I had been observing a range of behavior of bilingual and monolingual Spanish and English speaking students over the past year and a half. It was this incident in the middle of my second year that raised the question in my mind: How can library media specialists help bilingual and monolingual students learn information skills?

It is likely that during the course of their professional career every library media specialist will work with students who are non-English speaking monolingual, bilingual or multi-lingual students. From the smallest communities to the largest there are students who do not speak English, whose English capabilities are limited or whose reading skills vary across languages. In some schools this will be a single population with a single language group, e.g. Spanish, Japanese, Russian, French. In most schools, however, while there might be a predominant language group there will also be students with other language backgrounds. For example, while Michener Middle School had predominantly Spanish speaking students there were also Asian students who spoke Vietnamese and French and were learning Spanish. In other schools in this urban district there are at least 106 distinct languages represented among the student population.

My first response to the problems I encountered at Michener was, "If I learn Spanish then I can really help these kids." Upon a very short reflection I realized that yes it would be helpful at Michener and with the Spanish students. If I was going to be there for many years it would be a reasonable approach. However, what about the library media specialists who have 2 or 3 language groups in their school. Are we going to expect them to become fluent in all languages? What about schools where the population turnover is high and the languages of the students may keep changing? What about the media specialists who have little facility with languages? Do we simply ignore teaching information skills in these situations? Do we assume that someone else, e.g. the bilingual teachers, will do it? Do we say students can not learn information literacy skills until they have learned English? All these possibilities are statements I have heard expressed in my course of visiting various schools in various districts. The most common and the most disturbing is that students cannot learn and should not be taught information literacy skills until they are fluent in English. Fortunately, Michener Middle School has a different philosophy. Here all students are expected to learn information literacy skills and teacher, students and library media specialists work together to teach and learn as much as possible.

Bilingual Writing Center is a word processing and graphics program providing instructions in both English and Spanish. One of my favorite experiences as a non-Spanish speaking and reading teacher was having students help me understand the Spanish instructions for this software program. The day the event described here occurred there were a number of bilingual students in the library media center writing a report with Bilingual Writing Center. I often would circulate among students helping them start the program, change font, check spelling, save their work. This day I had been helping students get started and begin to type when I noticed two students in a corner who were well on their way to completing their written work. They had taken an Alpha Smart (small word processing computer) either home or worked with it after school. I was not quite certain since my Spanish is limited to a few words and phrases. They had transferred their report from the Alpha Smart into the Macintosh LC computer and were ready to save but were obviously having some type of problem.

When I went to help them, we struggled with language but I eventually figured out they wanted to save their report. I looked up at the menu bar and realized that I did not have a clue about which of the Spanish commands meant save. Since save and eject disk were close together I did not want to pick the wrong command. I tried to figure out from location the save command. One of the students kept asking me a question I did not understand and I would say, "No, Let's wait until I figure this out." Finally, he clicked on a button and all the Spanish language commands turned to English. With chagrin and apologies I thanked him, read the English language commands, memorized them and then indicated he could change back to Spanish. He hesitated, asked me one more time what I translated as, "Do you really want to do that?" and then clicked the button.

I read the words for save and for eject and then repeated them to the students. Next I explained to them the steps they could go through to save their information onto the Guest File in the hard drive of the computer and how to also save onto a floppy disk. They had known all along how to save. That was not the problem. The problem had been that they did not know how to access the particular place on the locked disk drive where they, as Guests, could save the information.

This is a long story to illustrate a simple point. Do not assume that students who speak another language are any different in their requests for information and help than other students. Use your reference and probing skills in the same way as you do with any student. A request for terremoto (e.g. an earthquake) from a Spanish language speaking student might really mean they want something about the Los Angeles quake of 1994. The problem is figuring out how to conduct these references interviews and further question asking across different languages. It can be done. But do not forget all you already know about kids, questions and library and information skills just because the student you are working with speaks and reads a different language.

Oftentimes ethnographers make both implicit and explicit value statements in their writings. So there is no confusion, this is an explicit value statement: I believe that we can not wait until students have English language skills before we teach them information literacy skills. There is much controversy in educational circles about language skills and the place of the public education system in providing education and materials for the non-English speaking student. I do not wish to engage in this controversy. I wish to clearly state my beliefs. I want readers to understand these beliefs underlie all I say. I am not neutral on this issue. Information should not be denied to students because of the language they speak. Information should be provided to monolingual students in the language they understand.

The problem of providing students with reading materials in their own language becomes compounded when a school has students with many different language backgrounds. Fortunately Michener Middle School was almost entirely Spanish speaking. The decision was made to invest in reference, non-fiction and fiction books in Spanish. In the first year I was at Michener, a number of new Spanish language materials were added to the collection, including science series, a high level encyclopedia and some literature. Computer software such as Bilingual Writing Center was added to the library's computers. I saw bilingual students using the library and engaged in reading information from these books on topics such as rain forest research.

The next year more Spanish language materials were added. One of the hallmarks of these new materials was their publication location. A recommendation from a Spanish language cataloger made all library media specialists in the district clearly aware of the differences between books published in Mexico and books published in Spain. The analogy was that to Spanish speaking students in this school district books published in Spain would read like Chaucerian English would read to English speaking students. It would be vaguely understandable but very difficult for most students. Michener also acquired a new grade appropriate reading level encyclopedia published in Mexico and a number of new books also published in Mexico. This emphasis on Mexican or South American imprints continues in the Spanish language materials that are purchased. In addition, acquisition of Spanish language materials to cover social studies and literary topics is ongoing.

Bilingual teachers use the library media center with their classes for a variety of assignments and activities. Early in the second school year bilingual students completed a study of biomes as part of their science curriculum. Later in the year the bilingual students completed a study of plants and their habitats which included the development of a multi-page brochure. Students also are using the new Newsbank in Spanish to find materials for their social studies units. Spanish language Web pages and sites are being searched and downloaded for students on a variety of topics including Spanish poetry. For the first time bilingual students had Shakespearean plays in Spanish and entered the Shakespeare Festival. Their scenes were read, learned and presented from the Spanish. Students also choose Spanish language materials for personal reading such as the Goosebumps series translated into Spanish. Unfortunately, there are fewer pleasure reading materials in Spanish than there are curriculum related materials. Limited resources and the relatively high cost of Spanish materials reduce the number of items that can be purchased.

Bilingual and monolingual Spanish students in Michener Middle School have a variety of appropriate curriculum related materials available to them that would not have been possible without a systematic process of informed buying. The purchasing of materials was first based on lack of resources. Once materials were purchased, their suitability and use by students was judged. Issues relating to how and why students used particular types of materials was evaluated. The second round of purchasing took these factors and curriculum factors into consideration. Each selection of new Spanish language materials increases curriculum use and student use of the library media center. Sometimes, even though the library media specialists provides appropriate materials, other factors interfere and provide constraints which can not be overcome.

During the second year I was at Michener the library media center, along with the subscription to Newsbank, received a Spanish language CD-ROM which had stories from South American news agencies. They were not quite of the same quality of other Newsbank information and some of the language was quite difficult for middle school students. However, the information was in Spanish, the students could use the regular Newsbank search strategies and there was more information on topics such as Selena or particular Spanish poets, writers and historical figures.

One day I noticed a group of 5 or 6 students hovered around a computer. They were looking for information on Selena for a report and had found more than 10 articles in Spanish. They were so excited. They kept having more and more students come over to look at the information.

This year Newsbank has discontinued their Spanish language CDs. These students have lost another resource that, while not perfect, had them practicing, searching and being successful. In addition, there were articles and topics that they knew about and were interested in. There will probably be another new product that crops up and there are Spanish language sites on the World Wide Web. This, however, was local, fast and the same as other students used. These students lost a feeling of community and sharing the same resources when Newsbank discontinued this service.

Conclusion

When I began my observations at Michener Middle School I was not looking at any particular activity just more generically at the relationships between the library media program and the school as a whole. As I spent more time in this school the impact of the bilingual and monolingual students on the information skills program became apparent to me. I began thinking about how these issues affect library media specialists in other schools and other places. I am still observing. My project has another two years. I have many more questions to study generated from the observations thus far. I believe that as a library media community we all need to address serving the information needs of students with languages, skills and cultures other than English. I present three questions below for consideration by library media specialists and the library media research community.

- How can we assure that non-English speaking and reading students will have the same access to information skills training and practice as other students?
- How can we develop appropriate strategies and techniques for working with bilingual and monolingual students when we, as library media specialists, may have limited bilingual or English as a Second Language training?
- How will we as a profession address the real and substantive problems associated with evaluating/assessing the information literacy skills of bilingual or monolingual students?

Information Skills Training

My thinking about the observations I have completed so far has resulted in some areas that I believe the profession needs to address more completely. These issues associated with teaching information literacy skills to bilingual and monolingual students include:

- communication problems between library media specialists and bilingual/ monolingual students
- evaluation of information literacy skills which students already have acquired
- relationships between bilingual/ESL teachers and library media specialists
- community pressures both for and against bilingual/ESL instruction and materials
- acquisition of materials in appropriate languages and appropriate dialects
- practice teaching information literacy skills to bilingual students
- students practice using information literacy skills in multiple locations and language settings
- motivation when both students and library media specialists are uncomfortable
- assessment/evaluation/testing methods
- pacing for teaching information skills
- special students (e.g. GT, special ed., etc.)
- parental involvement and access to information and resources in the home

Developing strategies and techniques for working with bilingual students

One of the techniques I use is to spend more time with the bilingual teachers at Michener. I ask them questions about how they go about doing the work they do. I ask them about their students and what we can expect from them. One of the most interesting responses not only from the teachers but also from bilingual aides and parents is that these kids often understand much more than they are willing to let on. They certainly understand very quickly phrases like: What is your name? Basic sentences. However, they may want to tease teachers, or play games or just make things difficult. This is to be expected. Library media specialists in school could ask bilingual or second language teachers more questions about techniques and strategies that work. If your school does not have a specialist there may be someone at the district level or in another district who could help. There are many books, conferences and online resources also.

- Office of Bilingual Education and Minority Languages:
  http://www.ed.gov/offices/OBEMLA/
- ESL/Bilingual/Foreign Language Lesson Plans and resources
  http://www.csun.edu/~hcedu013/eslindex.html
- TESOL online
  http://www.tesol.edu/
- Multicultural/Bilingual Education Clearinghouse
  http://www.weber.edu/mbe/htmls/meb.html

I also ask my university faculty questions about bilingual education and strategies and techniques. Perhaps in your district you could ask a university faculty member to speak with the library media professionals about ways to help bilingual and monolingual students. I use the resources, people and information around me that know about teaching and learning for students with different language backgrounds.

Assessing bilingual students information literacy skills

I believe the problems of teaching information literacy skills can be more easily resolved or at least solutions arrived at to help students than can the assessment of what they know and can do. It is not just language affecting assessment and evaluation. There are cultural and social meanings associated with test taking and evaluations which also must be considered. In addition, there is a resource intensiveness required to have assessments written in students' languages.

One of the critical assessment issues for performance and alternative assessments is the intensity of the language skills that are required. Issues such as those below need to be considered:

- complexity of the directions
- flexibility of the task for language use (e.g. are different languages acceptable? can the responses be in English, Spanish, both?)
- hidden language demands (even non-verbal tasks may have language needs)
- how much language will the student need to produce (oral, contextualized responses are more easily learning than written, academically based responses)\
- how cognitively demanding is the task

One approach to developing information literacy assessments might be for teachers and library media specialists to help students develop evaluative rubrics for assignments. Having bilingual and monolingual students write their own rubrics might serve two purposes. Assessments would be written in a language the students could read Secondly, students would have rehearsal of the project as they decide what they want to be evaluated on.

As I continue my research at this urban middle school I will be looking for ways to examine these questions. I will be searching for resolutions and solutions. I do not expect to answer all my questions. I do expect to generate many more questions and puzzles.

Afterward

John VanMaanen in *Tales of the Field* lays out three ways ethnographers write up the results of their research. He calls them realist tales, confessional tales and impressionist tales. As I reviewed VanMaanen's categories I believe my analysis falls between a confessional tale and an impressionist tale. It is confessional in that I make my voice and my reactions a strong part of the tale. This is how I felt and reacted. It is my story. It is impressionist in that I go beyond describing what I saw to explication of social issues and responsibilities: To expand the tale to how others might act based on this analysis.

All of the writers in the following annotated bibliography influenced how I conducted this research project. From the development of field notes, through the analysis of information, to the writing up of my observations, I have been shaped by Wolcott, VanMaanen, Geertz, Agar, Emerson et al and Wolf.

Annotated Bibliography

Agar, Michael H. (1980). *Professional Stranger: An Informal Introduction to Ethnography.* New York: Academic Press.
Michael Agar's book is one of the first I read on how to do ethnography. From this book I learned ways to conduct interviews. I used Agar's methods and ideas as I gathered interview data for this study.

Agar, Michael H. (1986). *Speaking of Ethnography.* Beverly Hills: Sage.
This book is a follow up to Agar's *Professional Stranger.* The pieces I used from this book are related to how ethnographers look for differences but also find similarities: across cultures, in language, within and without of themselves. It is technical and dense but made me think strongly about how to articulate differences between what I expected and what I actually saw.Emerson, Robert M., Fretz, Rachel I., & Shaw, Linda L. (1995). *Writing Ethnographic Field Notes.* Chicago: University of Chicago Press.
This book influenced the way I take field notes. It clearly demonstrates different ways to jot notes in the field, write up field notes, develop detailed notes, create a point of view, process your information and finally transpose the data into ethnographic text. I found the examples from both the authors and their students helpful in expanding my own style of fieldnotes. This is an outstanding resource for beginning ethnographers.

Geertz, Clifford. (1973). *The Interpretation of Cultures.* New York: Basic Books.
Geertz' book taught me that research can use language the way poets use language:
Writing up the results of research does not mean dry, dull prose with no feeling. Geertz' also taught me by example how to go beyond surface meaning and to look for "webs of significance". If you could only read one book on or about ethnographic work, my recommendation would be *Interpretation of Cultures.*

Geertz, Clifford. (1995). *After the Fact; Two Countries, Four Decades, One Anthropologist.* Cambridge, MA: Harvard University Press.
The title expresses the contradictions that come when writing ethnography. I paid close attention to those contradictions as I wrote this tale.

VanMaanen, John. (1988). *Tales of the Field: On Writing Ethnography.* Chicago: University of Chicago Press.
More than any other, VanMaanen's book has shaped how I behave as an ethnographic researcher. It is not so much in the text of the book that I found my own style. Rather it is the classic, contemporary and avant garde resources that VanMaanen refers to throughout his text that have shaped my thinking and research. Because of this book I have read about cocktail waitresses and kitchen workers, medical practitioners and police officers, principals and teachers. I have read ethnographies to become an ethnographer.

Wolcott, Harry. (1990). *Writing up Qualitative Research.* Newbury Park, CA: Sage.
Whereas Geertz is known for his "thick description" and layers of meaning, Wolcott is known for his clarity and directness. Both are needed in writing up the results of ethnographic research. When I read Wolcott, I know what I need to do and how to go about doing it. He paints a clear, ordered picture that as a library information professional I find accessible. This book is a straightforward explanation of how to take your data and help it make sense to others.

Wolcott, Harry. (1994). *Transforming Qualitative Data: Description, Analysis and Interpretation.* Thousand Oaks, CA: Sage.
Wolcott, in this book, made me realize that what I wanted to do here was analysis: Description was not enough. I wanted to lay the scenes and activities I had observed and then analyze them for meaning. I wanted to make sense out of the personal and professional questions that arose. I used this book to help construct my structure and organizational strategy.

Wolcott, Harry. (1995). *The Art of Fieldwork.* Walnut Creek, CA: AltaMira Press.
When I wrote this chapter I had not yet read Wolcott's *Art of Fieldwork.* However, I feel I would be remiss in not recommending this book to potential ethnographers. Like other Wolcott books it clearly lays out what one would want and need to do to conduct fieldwork. Ethnography has few books that are as clear and straightforward as this.

Wolf, Margery. (1992). *A Thrice Told Tale: Feminism, Postmodernism and Ethnographic Responsibility.* Stanford: Stanford University Press.
This book graphically demonstrates how the same ethnographic information can be used in different ways. Wolf presents an incident from her field work in three ways: as the notes themselves, as a traditional realist ethnography and as a short story. This book continues to make me think about how I present information to readers.

Author Biographical Notes

Dian Walster

I am the Associate Dean of the School of Education at the University of Colorado at Denver. I continue my work on the question of how to integrate information literacy skills for bilingual students. In addition, I am completing a book on *Student Centered Information Literacy Skills* which will be published in 1998. The most memorable moment of the conference for me was while I was sitting quietly on a balcony overlooking the Columbia River and thinking. I realized that as a profession we have an actualized, substantive and ongoing research agenda that is being carried out nationally and internationally by dedicated scholars. When Treasure Mountain I took place, there was a promise. Treasure Mountain VI demonstrated the results of that promise.

Deepening Our Knowledge of Young People in the Expanding Information Environment: A Model for Field Research

David V. Loertscher
Wayne Reeves

Abstract

This paper proposes a methodology for conducting field research in information literacy by three major groups of people but structured around an information literacy heuristic created by Wayne Reeves. Using the information literacy models as tools to study the major theories of the field, not just as models to teach young people, the field of school librarianship could become more reflective and partnering with researchers could advance the theory and practice of the field more rapidly.

Introduction

As the researchers and practitioners of the library and information community begin to grapple with the deepening information pool, a major problem exists. The pool is deepening so rapidly in so many schools that researchers taking a "picture" in a slice in time, draw conclusions about the information world which may have been true at one point, but may no longer be true.

Recently, a community college librarian noted that overnight, full text periodical access had gone from 300 titles to 3000 titles in his library. Instantly, student searching has been affected. But how should librarians and teachers respond to such radical shifts in information resources? It is certain that "business as usual" is not one of the options. The way assignments are given, the expectations for success, the new problems students will encounter, the types of products they would and could produce, the danger of information overload, — all would be problems to study in depth if the institution is to respond meaningfully to the learner.

The information literacy models currently popular with school library media specialists remain largely untested. The few studies that have been done are not sufficient for the profession to announce to the world that we have a definitive plan for information literacy.

The following paper suggests one method the profession might debate as a way to accelerate the amount of research being conducted, analyzed, and tested. Since there is little indication that research funding will increase any time in the near future, the authors are presuming that some realistic plan might have to be developed.

Part I

Rather than present an untested plan, the authors propose that the reader use a strategy for studying information complexity to examine the problem. What is the problem? It is:

How could the profession of school libraries study the information habits of young learners as the information pool deepens so that sound guidance for information literacy might be given?

The numerous learning and research process models currently published label certain steps or stages that a young person could use to explore a topic or problem of choice. The common elements of the various models are:

1. Formulation of a question or problem
2. Finding information
3. Analysis-synthesis of the information
4. Drawing conclusions
5. Presenting the results
6. Reflecting on the process and the product

The toughest part of the research process is the analysis-synthesis phase, for as students obtain a variety of resources from the information data sources, they are faced with the challenge of what to do with so much information. A focus on the processes of analysis and synthesis in information rich environments is the niche that we are exploring in this paper.

Wayne Reeves has developed an heuristic which not only might help learners as they face a vast world of information complexity, but might serve researchers and practitioners as they approach their own learning problems. An heuristic is a step by step guide to thinking, learning, or problem solving. It is an approach to learning that avoids rote memorization but gives the learner a tool applicable to a broad class of learning situations. It might be termed a knowledge management tool for the learner. The reader is challenged to go through the following steps in preparation for solving the information management problem stated earlier.

Step 1:

Read the Reeves Knowledge Management Tool (Fig. 1) carefully and try to internalize its meaning.[1] This could be done through simple memorization and understanding of the main parts of the heuristic.[2] If any part of the heuristic is unclear, proceed to step 2, otherwise, skip to step 3.

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[1] This prototypical model is adapted from *Cognition and Complexity,* (Reeves, 1996). The fully reduced, operationalized version of the problem solving skills model takes the shape of a flexible learning heuristic. It consists of a step by step guide that has the required capacities listed above and would be used in the task definition, engagement, and synthesis stages of what might be termed any typical use of the "scientific method" or discovery learning. Its framework forms the important filtering function, and creatively working through its unique stages or activities provides the transformation of information into meaningful chunks of related knowledge while facilitating the development of an adequate mental model.

[2] The complex learning techniques of the metaphorical, critical, systemic, integrative, and long term modes of thinking (Lakoff and Johnson, 1985; Halpern, 1993; Paul, 1992; Banathy, 1992; Senge, 1992; Baseeches, 1990; Sternberg, 1990) can all contribute to synthesized knowledge management techniques that help to assure that learning, i.e., schema or mental model construction, develops from a rich variety of intellectual perspectives. If we are setting out to manage information overload and, more positively speaking, to develop the capacity for determining informational quality and relevance, we need to apply thinking principles and specific portions of information processing styles that focus on those essential functions independent of the topic under investigation. For example, here is a portion of the domains of cognitive science synthesized for the Reeves' model (1996):

- *Cognitive Complexity*: The study of modern elements of information overload and other sources of learning complexity (Toffler, 1970; Gergen, 1991; Flood, 1992; Voss, 1990; Norman, 1989; Wurman, 1989; Machlup, 1985; Klapp, 1987; Goerner, 1990; and Prigogine, 1987).
- *Meaning Theory of Thinking:* relating new learning to familiar learning in both terms and concepts (Mayer, 1983).
- *Critical Thinking*: elements of learning must include the natural and artificial use of logic: deductive, inductive, and fuzzy. It must also include an investigation of the usefulness of the general critical approach to questioning and Socratic dialogue (Paul, 1990).
- *Metaphorical Thinking*: the broadly useful learning infrastructure would go beyond logic and allow understanding of abstract and unfamiliar concepts. Metaphor and analogical thinking must be implemented as part of any comprehensive learning heuristic (Lakoff & Johnson, 1980).
- *Systems Thinking*: in this chaotic, highly interactive, dynamic Post-Industrial-Information Society, any learning tool needs to have a focus on relationships, wholes, and change management (Senge, 1990).
- *Integrative Thinking*: this post-Piagetian form of thinking supports most of the concepts of systems thinking. Described as an adult form of thinking, it joins with reflective thinking and dialectical thinking as an advanced form of problem finding and problem solving. This newly researched field may also enhance our understanding through the process of synthesis that occurs with the integration of opposing views (Hurd, 1991; Perry, 1970).
- *Pattern Recognition Thinking*: lastly another possible source of fruitful investigation into thinking styles would come from the study of how we discover themes, patterns, and trends and how we link actions to consequences. High level pattern recognition would be valued in coming to an understanding of a vast amount of data with an overarching organizing principle (Sternberg, 1990).

The Reeves Knowledge Management Tool

Surface Learning

Deep Learning

1. Build Background (key dates, events, people. places)

2. Know key words

3. Know key concepts/ideas

RELATIONSHIPS

4. Diagram <u>parts</u> of the topic (classes, categories, objects)

5. Diagram <u>activities</u> that take place in your topic (actions)

6. Diagram the <u>environment</u> of the topic (financial, political, technological, sociological, educational, economic, artistic, religious, historical, location)

DEPTH

7. Draw analogies to something you already know (compare, contrast, describe)

8. Visualize (examine/create charts, tables, maps, diagrams)

9. Explain the topic to someone

10. Find themes, patterns and trends

Figure 1: The Reeves Knowledge Management Tool

Use the following elaboration and the model itself to deepen your own knowledge about the Reeves Model.

Focus on Foundations (Generative Activities 1-3)

Activity 1: Background - to build a context

1. What items are the focus of this activity ? How can you identify them? The items that you will find in your reading that apply to building a background on your topic are associated with:

Key Dates
Key Events
Key People
Key Places

Hints: Building background knowledge of your topic is very important because it will act as the anchor for the new information you will be trying to organize and learn. Giving yourself a chance to find out where the topic came from will save a lot of time in trying to recall or make sense of this new knowledge later on down the line.

2. Where are you likely to find them?

Hints: Wherever dates are found throughout your resources. Important dates may be underlined or typed in bold or highlighted in some way.

Excellent sources for dates, key events, people, and places are reference material such as encyclopedias and other historical summaries. Also these high leverage summaries give a lot of clues as to what is going to be important in your other reading or classroom discussion. History books or articles on your topic also offer excellent resources. Also websites such as the research site at http://www.itools.com may be very helpful.

Introductions and conclusions of chapters on your topic are excellent places to locate what the authors think were the most important dates, places, and events. Remember librarians in your school or public library can be of help in finding reference resources.

3. How many items are you looking for?

If your goal is Beginner level learning then you need only 5 background items. The key is to find some of the more significant background points. For this Target you need to look for the events or people that seem to be highlighted by the experts on your topic, the writers of the textbook, or your teacher, or an encyclopedia or other good references.

Always remember that if you are not a complete beginner with your topic you probably already know some background items. Consider what you already know in choosing the new learning goal you have for your selected topic. If you already have 5 background items for your topic fill them in and then move to Activity 2.

Activity 2: Key Words - to understand reading material

1. How can you identify items that belong to this target?

Hints: Key terms are words that have special meaning for your topic. Key words will be those words that you find repeated often throughout the book or chapter you are working on. These words will most likely be defined and highlighted in the text or discussion.

2. Where are you likely to find them?

Tip: Key words are those words the teachers, authors or experts think are the most important thus they should be discussed up front in the Introductions to books and chapters or in your teacher's classroom discussions. They can also be found in Glossaries, Indexes, or in the Chapter titles found in the Table of Contents. Remember librarians in your school or public library can be of help in finding reference resources. Also websites such as the research site at http://www.itools.com may be very helpful.

Activity 3: Key Concepts - key terms that have broader more general meanings

1. How can you identify items that belong to Activity 3?

Hints: Key concepts are sometimes difficult to locate. What is a concept anyway? For our purposes concepts are powerful key words full of meaning including other key terms. These words will most likely be defined and highlighted in the text or discussion just as were the key words.

2. Where are you likely to find them?

Hints: Key concepts are key words with broader meanings so like key words they are those words teachers, authors or experts think are the most likely to discuss up front in the Introductions to the books or beginnings or conclusions of each chapter. They can also be found in glossaries, indexes or in the titles found in the Table of Contents. Remember, librarians in your school or public library can be of help in finding reference resources.

Focus on Relationships (Generative Activities 4-6)

Activity 4: Diagram the parts of your topic

Diagram - all components; elements; objects that makeup the topic being studied. This means that as you locate and list the components of your topic place them in a simple diagram that groups things visually for you. Figure 2 diagrams some of the components of a "band or orchestra."

Topic: Bands and Orchestras:
Parts

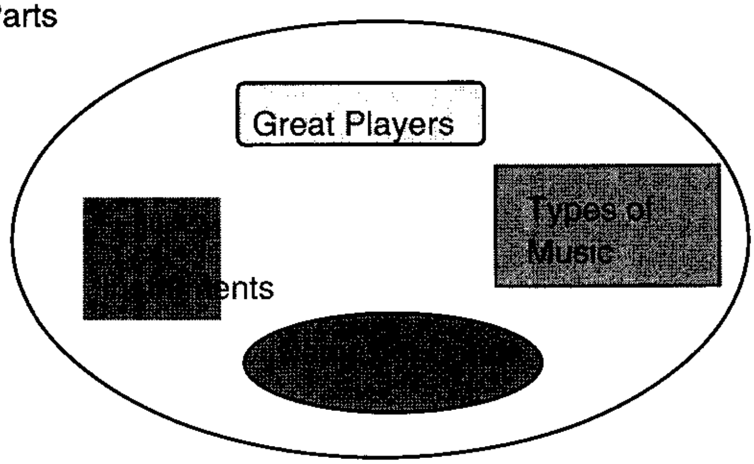

Figure 2: Bands and orchestras.

1. How can you identify items that belong to Activity 4?

Hint: think physical; visible objects, parts and components; think classes or categories of the objects that are part of your topic; people, events, tools used, etc. Think what performs the functions that occur in the topic. If your topic was orchestras or bands you might think of the components as 1) the top players, 2) the different kinds of instruments, 3) the types of music played, 4) the composers and arrangers, etc. these are some of components of an orchestra or band.

2. Where are you likely to find them?

Encyclopedias and other reference sources that one can find in your school or public library. Look for descriptions of your topic in the introductions to your textbook or the specific chapter that refers to your topic. Another good source is to self-generate the **Parts** through a mental analysis of the topic under consideration. Or ask someone that knows about the topic if they might describe it to you.

After you have listed the parts of your topic take out a piece of paper and draw a circle and place the parts in that circle-- you now have a picture of your topic as a system of parts.

Activity 5: Diagram the activities that take place in your topic

Diagram - all processes or actions that occur in, or because of, or in the development of your topic right on your topic diagram. Hint: Think of the actions that take place within your topic. We might call these actions the functions or activities of the topic. See Figure 3 below:

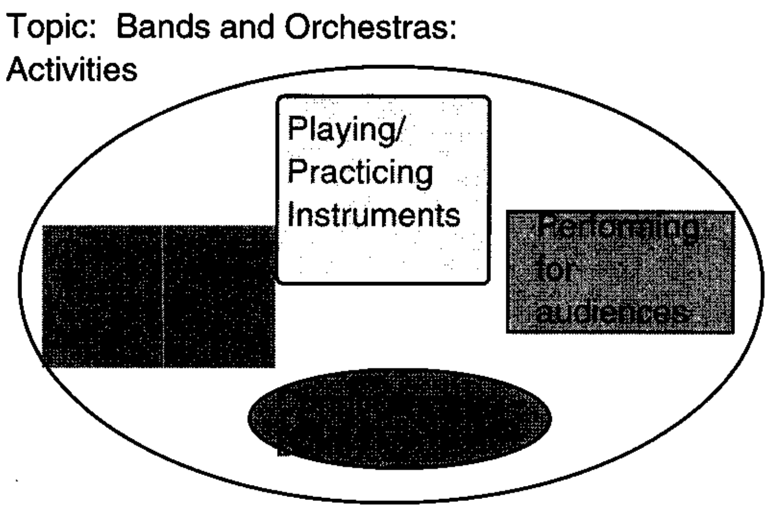

Figure 3: Bands and Orchestras

Tips: If your topic is something like a school system or a computer system or a financial system there are some general tips to identifying and classifying the activities that take place within the system. General functions of any of these types of topics include 1) input functions; 2) transformation functions; 3) output functions; and 4) feedback functions.

So we would ask ourselves what processes manage input into your system of parts? What processes manage the changes that happen to the input and maintain them until they are output? For a school system we might identify the following:

Input Functions: Personal and Community expectations of what an education will produce in terms of what students will know.
Also, there would be all the activities that raise money, select textbooks, bring students, recruit teachers, and involve parents.

Transformation Functions: For a school this is the teaching and learning process. That is, the activities between the students and the teachers and school librarians that transform an uneducated student into a knowledgeable student.

Output Functions: The outputs of the system are those activities that get students prepared for graduation and other evaluation. Output also includes educated students. Or students that are schooled and have the skills to continue their education throughout their lives.

Feedback Functions: This would include the parents evaluation of how well they think the schools are educating their children. This feedback might show up as an evaluation or as the support the community gives to the school financially and in other ways.

Hints: The idea here is that for all topics there are some activities that take place between their component parts. We want to identify those and add them to our diagram. In other well organized topics, we call systems, we can use the more sophisticated input/transform/output activities format as a model of organizing our thinking about the activities that are taking place within that system.

1. Where are you likely to find them?

Explanations in good encyclopedias and other reference works like the How it Works series. Look for descriptions of your topic in the introductions to the related parts of a book or chapter. Look for key words such as actions, activity, functions, or process. If you are familiar with the subject another good source is to self-generate the activities through a mental analysis of the topic under consideration. Or ask someone that knows about the topic to describe its functions to you.

Activity 6 Diagram the environment of your topic

Diagram the environmental forces that seem to have an affect on the topic. But are not really a part of the topic itself. They are outside the boundary of your system, a boundary you decide on yourself.

1. How can you identify items that belong to this target?

Hint. Think of financial, political, technological, sociological, educational, economic, artistic, religious, historical, physical location, geographical, scientific discoveries and people and processes that surround this topic. That make a larger context for the topic. Look at Figure 4 below: Bands and orchestras are placed within the larger context of music and the arts.

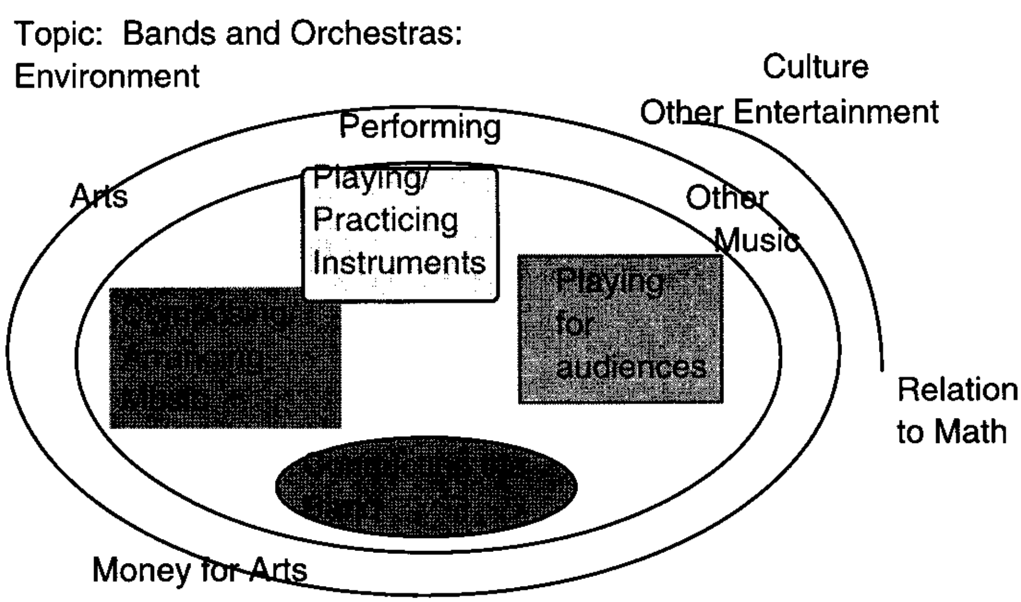

Figure 4: Bands and Orchestras in a Larger Context

2. Where are you likely to find them?

Books on the subject. Look for descriptions of your topic in the introductions or other parts of a book or chapter that is related to your topic. Another good source is to self-generate the context or environment by thinking about the topic under consideration. Or ask someone that knows about the topic to describe it related but external elements to your topic.

Tip: School Librarians are also good sources of reference materials where these items may be found.

Focus on Depth (Generative Activities 7-9)

Activity 7: Analogy

Relate the subject to something you already understand really well. Compare and describe the qualities of the new topic in terms of something that you already know very well in as many different ways as possible.

1. How can you know when you have an analogy that will help you understand the topic?

Hint: The more ways that you can compare the new topic to something you really understand the higher the possibility that you have a great analogy. Thus, the more detail you can bring into your analogy the better. Compare the known to the unknown in as many ways as possible. So if you want to say your family is like a tree; what in your family is related to the "roots", the "branches", the "leaves", and the "trunk" of the tree.

2. Where are you likely to find them?

These are self-generated since the analogy is related to something you know. But you can also look at what others have used as analogies to this topic. Scan your references for comparisons of your topic to other things; analogies are used quite often by authors, teachers, business leaders, and lecturers to help their audience understand what they are trying to say.

Tip: Analogies are very prevalent in poetry.

Activity 8: Visualize

Draw a picture of your topic in any format that makes sense to you or look for published diagrams, etc.

1. How can you identify items that belong to this target?

Hint: Look for any charts; graphs; tables; pictures; maps; schematics; that you can.

2. Where are you likely to find them?

Self-generated. Drawing your own pictures. Encyclopedias and other references. Reviewing any books or articles on the subject skimming for diagrams of any sort. Charts are especially revealing when trying to understand a topic.

Activity 9: Critical Conversation

Explain the topic to a friend, fellow student or colleague.

Hint: Engage in a critical discussion of the topic by encouraging your discussion partner: parent, friend, or fellow student to ask "probing questions" like why? or how? or what did you base that statement on? during your explanation. Secondarily, you could ask yourself if your explanation seems logical or seems to make sense?

1. How can you identify items that belong to Activity 9?

You can identify this type of conversation because it will contain probing questions. Questions that ask why, what, how, when, etc.?

2. Where are you likely to find them?

These conversations are self-generated. But it is also possible to find debates, arguments, and other persuasive or critical-type discussions in other reference sources from magazine, journals, television, the Internet, and newspapers, as well as, books and textbooks.

Focus on Depth and the Long Term (Generative Activity 10)

Activity 10: Themes, Patterns, and Trends

Find a theme, pattern, or trend that applies to the topic. This is the step when you are asked to find out how your topic has changed over time or is predicted to change in the future. It also asks for the larger purpose to be found in your topic. Where it seems to be applicable we want to find out what larger message your topic is trying to communicate.

Themes: or what is the essence of the topic? What is the topic really about from a broader perspective? What is the author's intention behind the surface of the story? What is the author's or the discussion's point of view? Example: The theme of the turtle and the hare fable is that slowly but steady will win out over flashy but inconsistent.

Tip: It is also possible to find a theme in a textbook by identifying an idea that repeats each chapter. This would then be the central idea around which new ideas would be linked and presented to you. If you can identify this repeating notion you have discovered one of the high leverage pieces of information that is key to understanding the text. It will make reading and listening to related material much clearer and easier to follow.

Patterns: occur when parts of the topic are related in a certain way to other parts and this relation seems to be repeated over and over again.

Tips: One of the most useful patterns to become aware of in the learning process is the pattern of presentation found in textbooks. An example of a repeating pattern of presentation is found in this very Hints and Tips Help. At the beginning of the Help we wrote:

"The template for each of the following Hints and Tips:

a. What is the target?
b. How can you identify items that belong to this target?
c. Where are you likely to find target items?
d. How many items are you looking for?
e. Examples are linked to each target.
f. In Depth material on the research behind each of the steps is also linked."

Each of the Hints followed this general pattern and allowed the reader to predictably move from one Target Hint to another.

Tip: In textbooks the pattern of presentation can actually help you to understand the topic being discussed. For the book as a whole there is the overall pattern of introduction, body, and conclusion. In each chapter there is a similar pattern of introduction, body, and conclusion. Also within the body of each chapter there is a progression of key words and concepts building one upon the other.

These concepts then become the basis of the new learning in the next chapter and the pattern is repeated chapter by chapter. Once the particular textbook's pattern is discovered it helps to visualize the relation between the concepts as they are presented in successive chapters. It helps you to make distinctions and notice what new bits of information are being added with each chapter. Noticing this pattern helps to ease the assimilation and incorporation of the new material into your existing knowledge structures.

Tips. Look for visuals, templates, standards. Look for things that repeat themselves.

Trends: The direction that the patterns in the topics take over time. Their evolution. Trends move up and down, change their look or style over time.

Tips. Look for graphs and charts: Well known examples are Fashion trends, Music trends, Stock Market trends.

Step 3:

Test your own skill by thinking through how you would solve a typical problem using the Reeves Model. Have you internalized the elements of the heuristic sufficiently to attack the main problem of this paper?

Sample problem: You probably have some general knowledge of the Donner Party and their attempted crossing of the Sierra Nevada Mountains in 1847 on their journey to California. You probably know little, however, about the four rescue parties who risked their lives to save the starving group. What methods would you use to explore this topic and be able to write a paper or a reader's theatre dramatizing the rescue?

Part II

Engaging Problem:

How could the profession of school libraries study the information habits of young learners as the information pool deepens so that sound guidance for information literacy might be given?

Challenge:

Use the Reeves model or another model to plan an attack strategy/solve the engaging problem. Your plan might take into consideration the following parameters:

a. It assumes that that the deepening information pool is a moving target.
b. It would be a practical solution and doable by the researchers and practitioners of the field.
c. It would take into account the work being done in other fields of study.
d. It would begin to carve out a role for the knowledge manager (the librarian).

*****Stop here and think through your own solution before considering the following proposed solution.*****

A Proposed Solution: Create a network of knowledge managers working in the field of information technology (formerly school librarians working in the field of library science) to create and test an array of models and strategies to accomplish the task. A sample network might be structured as shown in Figure 5:

C Group	B Group	A Group
Theory Consultants	**Model Designers**	**Model Testers**
Role	Role	Role
1. Think about models	1. Design models	1. Internalize model
2. Recommend other models	2. Have As test models	2. Test model
3. Assess progress	3. Gain feedback from As	3. Report to Bs
	4. Revise models	4. Help Bs revise
	5. Retest models	5. Test revision
	6. Submit models to Cs	
	7. Revise models and test	

Figure 5: ABC Research Groups

C Group Role: The C group consists of theory persons who are working on developing theories about young people immersed in the information world. For example, Wayne Reeves is the person who developed the complexity model for this paper and is construction and testing the theory on an on-going basis. This is a small group of theorists who meet annually or biannually.

B Group Role: This is a much larger group of "library educators" and "advanced practitioners" who are developing models based not only on their own expertise but on the shared expertise of the model testers. They direct an annual conference that receives reports on the tested models, revises or fine tunes the models and sends the models back out into the field for refinement.

A Group Role: This group includes building-level knowledge managers who have the liberty to test and refine various models on the populations they serve. Annually, they report back in conference to the B Group, comparing what they did with others who tested the model and refining the model to try again. A test of a model might take three years and then a second model enhances the previous model might be tried. The C group might consist of 100 knowledge managers.

Figure 6 shows the developmental process between theory and practices as teachers and knowledge managers as they consider what kids should know and be able to do and the information infrastructure as they design educational experiences.

The Knowledge Manager is:
1. Chair of the building technology committee
2. Assistant principal in charge of the information infrastructure
3. Supervises technicians, clericals, para-professionals
4. Supervises the information network in the building extending out to the world information network.
5. Spends 70% of time working on collaborative initiatives with teachers and departments.

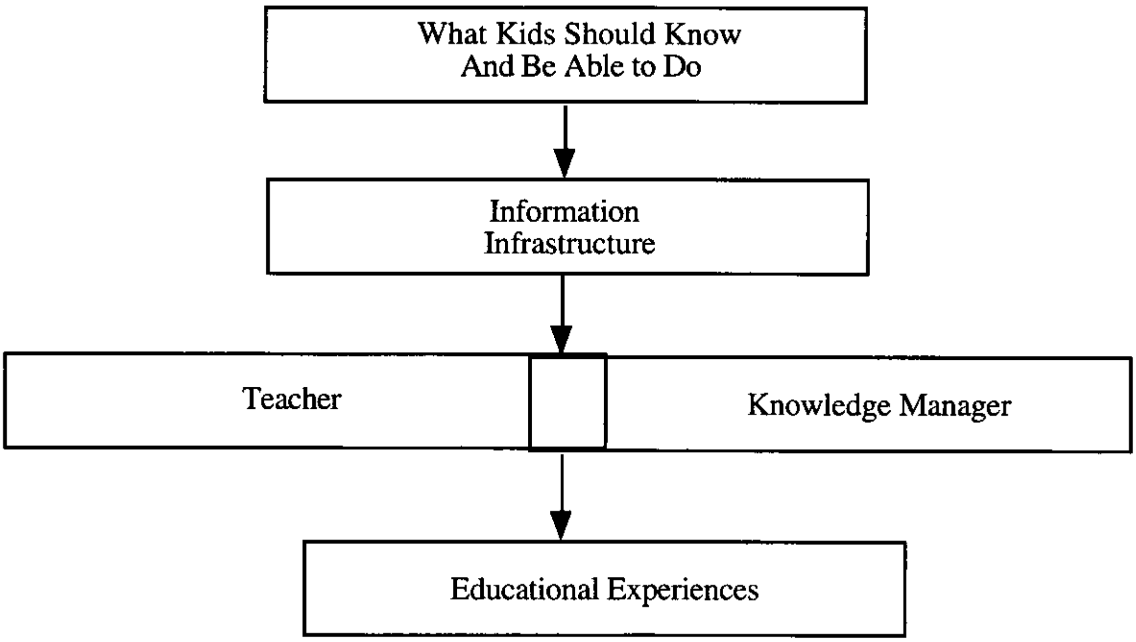

Figure 6: Role of Teachers and Knowledge Managers

Summary

The speed at which practice in the field of school librarianship is catching up to theory and surpassing it, requires that the theorists of the field and practitioners join hands to advance the information literacy movement by giant steps. While information literacy models abound, practicing professionals are in a position to test those models if they systematically document what they are experiencing and feeding it back to theorists. This paper has proposed a network and tiered collaborative structure and has challenged the reader to propose other solutions to solving the problem of advancing the knowledge of the field. There are too few researchers in the field with little incentive to collaborate. The result is a very slow evolution of ideas in a field where the advance of information technology is outstripping our ability to assist young people in its management.

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Part Three

Teaching and Learning Information Skills

UNDERSTANDING THE INFORMATION-SEEKING BEHAVIOR OF HIGH SCHOOL HONORS STUDENTS: INSIGHTS FROM PSYCHOSOCIAL THEORIES

W. Michael Havener
Kathy Latrobe

Abstract

This paper explores the potential of six psychosocial theories for explaining the information-seeking behaviors observed in a study of high school honors students. The six theories examined are alienation theory, gratification theory, knowledge gap theory, resilience theory, dynamic social impact theory, and social cognitive theory. Each theory can offer some insights into the observed information-seeking behaviors of these honors students. Student characteristics that were consistent with psychosocial theories include sense of inclusion in social networks, expectations for one's self, sense of control over the events in one's life, and ability to construct meaning.

Introduction

With the support of the 1994 Frances Henne YALSA/VOYA Research Grant, the researchers conducted an exploratory study of the information-seeking behavior of all students in one eleventh grade honors math class. Both applied and theoretical considerations led to the selection of this group. Because these students had achieved greater academic success than most of their peers, the researchers speculated that understanding the information-seeking patterns of these students could aid educators in developing strategies for improving the information-seeking success of all students. A summary of the findings of this study has been reported in *The Journal of Youth Services in Libraries* (Latrobe & Havener, 1997), but the researchers recognize that effective interventions must rest upon clear theoretical frameworks.

This paper explores the degree to which the findings reported *in The Journal of Youth Services in Libraries* correspond to behaviors that various psychosocial theories predict. The researchers examined six current theories, weighing the consistency between the study's findings and those theories. Three of the six theories (alienation theory, gratification theory, and knowledge gap theory) have been applied to information-seeking behavior through the research of Elfreda Chatman (1990; 1991; 1995) and others. The other three theories (resilience theory, dynamic social impact theory, and social cognitive theory) have been developed by researchers in other disciplines and have potential for explaining information-seeking behavior.

These six theories will be explored individually in the order given above. After brief explanations of the basic concepts of each theory, the methodology and findings of the 1994 study of high school honors students will be briefly summarized. Theories will then be applied to that study, and each theory's potential implications for understanding information-seeking behavior will be discussed.

The researchers recognize that issues of generalizability may legitimately be raised. The subjects in the study were limited in number (18 students), homogeneous, and atypical of larger student populations.

However, the number was appropriate for an exploratory qualitative study, and this atypical group was deliberately chosen in order to focus on unusually successful students. From the perspective of theory development, looking at outliers can sometimes provide a sharper image than focusing on the norm. For example, Elfreda Chatman's focus on the information poor has provided valuable insights into information seeking in general (1990; 1991; 1995). This study's deliberate focus on an information-rich group can similarly be used to highlight theoretical concepts that can then be applied in broader contexts.

Alienation Theory

Alienation theory attempts to identify reasons for the failure of human beings to interact successfully with each other. The theory explores five major perceptions that are characteristically held by alienated individuals: powerlessness, meaninglessness, normlessness, isolation, and self-estrangement. These perceptions then become barriers to successful information seeking. The perception of powerlessness leads individuals to feel they have no control over the events that affect their lives. A feeling of meaninglessness interprets the external environment as random, unpredictable, and usually hostile. Normlessness reflects a lack of standards or expectations to govern behavior. Isolation, real or perceived, leads to lack of support, confirmation, or guidance from other individuals. It also leads to a lack of concern for other individuals. The alienated individual is self-estranged, lacking in both self confidence and self esteem. Any one of these factors can discourage systematic information seeking; combined factors create nearly insurmountable barriers (Chatman, 1990).

Gratification Theory

Gratification theory attempts to explain behavior through a set of propositions. The ability to postpone gratification rests upon individuals' world views, expectations, lifestyles, and the time frames in which they function. Those who seek immediate gratification tend to have a world view that is narrow, localized, and extremely concrete. They see the world as risky, unpredictable, and often hostile. The norms that they share with families and friends lead to low aspirations for themselves. Low expectations are coupled with a perception that success is random and due to luck rather than work or planning. Such individuals lead what has been labeled as a "first level" lifestyle. Their focus is upon immediate concerns and reliance upon personal experience rather than more distant sources of information. Seekers of immediate gratification have limited time horizons and base actions upon short-term, rather than long-term, consequences (Chatman, 1991).

This theory has obvious implications for information-seeking behaviors. An individual with a short time frame will not be willing to wait for information that is not readily available. Narrow world views discourage consideration of new or nonlocal sources of information. Moreover, low expectations and the belief that the world is unpredictable thwart any motivation to exert the effort needed for information seeking.

Knowledge Gap Theory

Much has been written about the gap between the information rich and the information poor. People with greater economic resources also tend to have better information sources. Knowledge gap theory looks for possible explanations for inequitable information access. Rather than focusing solely on social status, knowledge gap theory attempts to provide a situational model that places information seeking in the context of a specific need. Motivation and the knowledge levels at which individuals function are used as predictors of information-seeking behavior. The urgency of an information need determines motivation level and predicts the effort an individual is willing to expend in information seeking. The knowledge level that individuals draw upon can be either "first level" (immediately verifiable by first-hand experience) or "second level" (originating outside lived experiences). If an individuals trust only first level knowledge, the information resources upon which they can draw are severely limited (Chatman & Pendleton, 1995).

Resilience Theory

Resilience theory (or resilient child theory) provides a model for explaining why some individuals succeed even in hostile environments (Mathews, 1996; Wang, 1995). It focuses upon the psychological characteristics of those capable of surviving and flourishing in socially acceptable ways. Researchers exploring this theory do not concentrate on individual weaknesses but rather on strengths. Among the many factors that researchers have associated with resilience are five strengths identified by Vanistendael (1995, p. 6):

1. Social support networks that provide unconditional acceptance.
2. Ability to find meaning in life.
3. A sense of control over events in life.
4. Self-esteem.
5. Sense of humor.

Each of these factors presents opportunities for intervention as young people interact with their environments. Because one is never absolutely resilient and because one's capacity to cope varies across time, place, and situation, there is a constant need to nurture these qualities. By learning how young people solve problems on their own, intervention can more wisely build upon successes that young people experience (Vanistendael, 1995).

Social Dynamic Impact Theory

Social dynamic impact theory attempts to explain the varying impacts of different sources of social influence on the behavior of individuals. This theory assumes that all individuals have relatively stable physical locations. The strength of any source's social influence upon an individual is correlated to the source's perceived authority and reliability, to its physical immediacy relative to the individual, and to the number of other sources influencing the individual. The importance of an issue to an individual also influences the ability of a source to change that individual's perceptions about the issue. Social dynamic impact theory predicts that the outcome of social interaction will be either group-level consensus or clustering of opinions (Latane, 1996).

Facets of this theory have potential implications for explaining some common information-seeking behaviors, such as the tendency to rely on sources that are immediately available. This theory can also suggest types of interventions that are likely to change information-seeking behavior. Issues of immediacy and number of sources of influence can be used to tap into social networks to modify behavior.

Social Cognitive Theory

Social cognitive theory examines the interaction of individuals with their environments. An important component of the theory is the concept of self-efficacy. Self-efficacy describes an individual's power to control outcomes and produce effects. The research of Bandura in partnership with others describes a variety of attitudes and behaviors that are influenced by self-efficacy beliefs: "aspirations and strength of goal commitments, levels of motivation and perseverance, resilience to adversity, quality of abstract thinking, causal attributions for successes and failures, and vulnerability to stress and depression" (Bandura et al, 1996, p. 1206). Self-efficacy beliefs influence cognitive, affective, and motivational processes within a complex psychosocial network.

According to Bandura's model (1996, p. 1215), self-efficacy in young people has three dimensions: academic efficacy, social efficacy, and self-regulatory efficacy. These three dimensions are influenced in part by socioeconomic status and parental aspirations, and they interact with environmental factors to affect academic achievement. Self-regulatory efficacy has significant educational implications: ability for self-directed lifelong learning and for developing metacognition which can include "selecting appropriate learning strategies, testing one's comprehension and state of knowledge, and correcting one deficiencies, and recognizing the utility of cognitive strategies" (Bandura, 1996, p. 1219). According to social cognitive theory, young people must develop the capacity to manage the personal and social factors that can influence their cognitive functioning.

The Study of High School Honors Students

This examination of the information-seeking behavior of high school honors students collected quantitative and qualitative data on the information environments of all students in one eleventh grade honors math class. Data were gathered through both a written survey instrument and individual structured interviews with students. Data revealed that these students functioned in an information-rich environment with many choices and that they usually went to the sources that they felt would be most useful regardless of format. Although students consulted a wide range of printed and electronic information sources, they exhibited a strong preference for seeking information from other people. Students were supported by strong interpersonal networks that included a wide variety of adults as well as peers. These networks facilitated access to individuals whose expertise they could tap to meet their informational needs. In addition to functioning in similar environments, these successful students tended to share some of the same personal characteristics, including flexibility, determination, curiosity, and self confidence (Latrobe & Havener, 1997). The environmental factors and personal characteristics identified by the pilot study are components of various of the psychosocial theories examined in this paper.

Application of the Six Theories to this Study of High School Honors Students

Each of the six theories explores both personal characteristics and environmental factors in an attempt to explain behaviors. Much of the information-seeking behavior of the honors students in this study could potentially be explained by environmental factors included in these theoretical models. However, the elements of these theories relating to personal characteristics were even more evident in students' discussions of their information-seeking, and those elements tended to cluster. Four major clusters emerged: (1) a sense of inclusion in social networks, (2) high expectations for one's self, (3) a sense of control over the events in one's life, and (4) the ability to construct meaning.

Sense of Inclusion in Social Networks

Students in the study indicated that they had strong interpersonal networks that played a central role in their information-seeking activities. Other individuals were the students' preferred sources when seeking information. Students were skilled at utilizing social networks for information gathering and sought information from peers, from parents, and from other adults who were part of their networks. One provided an example of reaching city government officials through a teacher who was married to the mayor. Many utilized the social networks of their parents. Noting his father was an Episcopalian priest, one student explained, "He knows a lot of people through the church so that's how I got in touch with this doctor." Other students acknowledged using the social networks of parents who were associated with the university or the medical community.

Students' networking included the use of organizations and technology. Over 78 percent had recently sought information from clubs or other social groups, and interactive technology was viewed as a mechanism for extending social connectedness. One student observed, "I swear, Internet has probably suited me more than anything else because there are so many people out there who are so knowledgeable—you don't know where your world stops."

All six of the psychosocial theories contain elements that relate to networking. Alienation theory discusses isolation, the lack of social networks; gratification theory suggests that networks can reinforce perceptions, such as belief in the random nature of success and/or low self-expectations; knowledge gap theory suggests that the differences in the social networks of the information-rich and the information-poor is one of the causes of inequities in the distribution of information; and social dynamic theory explains the relative impact of information sources on the basis of the sources' placement within the individual's social network. The ability of these students to analyze their use of social networks illustrates the reflective thinking that is a component of social cognitive theory. Supportive social networks are particularly central to resilience theory, which sees accepting and nurturing social networks as one of the keys to creating resilient individuals.

Expectations for Self

A second cluster of concepts can be grouped under the umbrella of students' self-expectations. Self-expectations are directly tied to self-esteem, self-confidence, and the perceived norms that govern an individual's behavior. Individuals' expectations for themselves can also be central to their motivation to seek needed information. This group of honors students exhibited high levels of self-confidence and self-esteem as reflected by such comments as, "I have a very forceful personality, as I see myself" and "I usually find the information I need; I know where to look for it." The normative expectations that they held for themselves were high. They anticipated continued academic and social success, and parents and teachers had reinforced these expectations.

The importance of self-expectations to success is highlighted by both resiliency theory and social cognitive theory. Alienation theory and gratification theory look at self-expectations from the opposite direction. The alienated individual is self-estranged and lacks normative standards to guide his/her behavior. Gratification theory illustrates how shared norms can lead to low expectations and aspirations.

High motivation, growing out of high self-aspirations, was a major characteristic of the young people in this study. They rarely stopped seeking information before they had closure (e.g., an assignment due date, a health concern that no longer needed attention, or a satisfactory answer to the information need). Respondents described a level of personal motivation that extended well beyond the actual need for information. One stated, "I've never stopped [looking for information on the topic]. There is always an infinite amount of information out there. . . ." Another noted, "I will keep on looking as long as I'm interested." A third observed, "I am still looking--all the time."

Although most of the students had at some time made a decision not to seek certain information, they described specific constraints (e.g., lack of time) that influenced them. Decisions not to seek information were related to specific circumstances not personal characteristics. This behavior is consistent with knowledge gap theory. In general, the students characterized themselves as diligent, making such comments as: ""if I want to find something out, generally I go after it and find out what it is I need to know;" "I can't see myself needing something and just sitting there;" and "If it's important to me, then I'm going to figure out what I need."

The levels of motivation they described reflected facets of personal expectations, aspirations, and self esteem contained in resilience theory, knowledge gap theory, and social cognitive theory. In contrast, the lack of the positive forward thinking that drives such motivation could be used to explain failure to seek information. Both alienation theory and gratification theory provide models for understanding such self-defeating behavior.

Sense of Control

Another clearly discernible characteristic of these young people was their sense of control over their environment. Students believed their approaches to information-seeking would result in success: "I think there are ways to find out most things you really want to find out. There are places you can go even if it might take a lot of searching to do it." Although certain types of information were difficult for some students to acquire, most respondents voiced confidence that they were and would continue to be able to get the information they needed. Typical remarks included: "I usually find the information that I need. I know where to look for it; I'm logical; and my parents taught me to be thorough and complete. I always tend to find a lot of things by asking questions;" "I've been able to get all the information that I need;" and "if it's important, I figure out what I need."

The issue of personal control, power, or influence is basic to resilience theory, alienation theory, and social cognitive theory. Within the framework of social cognitive theory, Bandura (1996) has created a model that demonstrates self-efficacy's influence on achievement and mathematically describes the interaction of self-efficacy with other elements in a young person's social and psychological world.

Sense of Meaning

The fourth major cluster of characteristics related to students' ability to forge meaning from their experiences. Students described the ways in which they constructed the frameworks that regulated their cognitive processes. They identified various cognitive problems they had encountered in accessing information, including: bias in reporting (e.g., "I think a lot of time I only get one perspective"), the nature of the topic on which the information was sought (e.g., an uncommon subject, a very narrow topic, or abstract/philosophical issues), the intellectual level of the material (e.g., the need "to find a happy medium between *Newsweek* and *JAMA*"), gender inequities (e.g., the lack of historical material about women), and the currency of a topic (e.g., lag time in the indexing of material). Awareness of the nature of a specific information problem shaped students' strategies, leading them to change subjects, to refocus topics, to seek other types of sources, and to ask new questions within their social networks.

Students revealed metacognitive awareness when they explained their information priorities. For example, school related information needs were most common but not always as pressing as a special problem (e.g., a medical problem). Students also displayed metacognitive awareness when they justified use of an information source that they considered to be less valuable than another, noting issues of time and personal feelings of comfort (e.g., "When I am under a lot of stress, I kind of just close up. . .").

Although the structured interviews did not specifically invite their comments on the broader philosophical issue of finding meaningfulness in life, most students communicated a belief they were functioning in a meaningful world where actions have consequences and what they do makes a difference. For example, one student noted, "[I'm] still looking--all the time. I think [an understanding] will come as I learn more about who I am and how I play. I think one day I may be able to help the next generation with this problem [performance anxiety]." Another observed, "I think that part of being a good citizen is being informed about what's going on in the world, and I think that it's good to be curious and learn all that you can." However, their constructions of meaning were not always socially acceptable. One student confided, "When I didn't have the information I needed, I made up the data."

The students described constructing meanings that regulated not only their cognitive processes but also their philosophical approaches to life and their psychological frameworks. Strands of alienation theory, gratification theory, resilience theory, and social cognitive theory provide insight into how their constructed meanings influence their information-seeking behavior.

Conclusions

The six theories share similarities and differences. The predicted outcomes for individuals demonstrating each theory's characteristics vary from neutral (social dynamic theory and social cognitive theory in which ranges of factors create influence) to negative (alienation theory, knowledge gap theory, and gratification theory which tend to explain lack of success) to positive (resilience theory which offers personal characteristics that explain success or achievement). Often differences relate to the fact that one theory is the flip side of another. For example, alienation theory explains lack of success as an outcome of isolation, and resilience theory explains success as one product of strong social support systems. Some aspects of the theories address the environment—e.g., parental expectations and socioeconomic status (social cognitive theory) or issues of immediacy and accessibility (social dynamic theory and knowledge gap theory).

The personal characteristics and behaviors of students in this study can be explained by elements from all six theories. The preliminary exploration presented in this paper illustrates the potential richness of these psychosocial theories for understanding the interaction of multiple factors that influence information-seeking behavior, for constructing predictive models, and for designing theoretically sound modes of intervention.

Among these theories, social cognitive theory especially has a number of implications for practice. It emphasizes the importance of the vision that adults, particularly parents, hold for young people. Librarians who reach adults within a young person's social network develop avenues that can strengthen students' aspirations. Tapping into these networks also provides an opportunity to reinforce messages librarians wish to convey to students. Social cognitive theory also emphasizes self-regulation, an element of metacognition that has important implications for self-directed learning, an ability that has great significance in a culture of accelerated technological change. In such a culture, as Bandura has observed, "The knowledge gap will widen between good and poor self-directed learners" (Bandura, 1996, p. 1219). Young people need to develop self-regulatory skills to help them choose their own workable learning strategies, to test their comprehension, and to correct their deficiencies. Furthermore, instruction should extend to include the skills that help them regulate their own motivation levels and the social networks that influence their academic achievement.

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Skills, Information Skills, and Information Literacy: Implications for Teaching and Learning

James O. Carey

Abstract

Clearly one intent of national-level reports such as the Secretary's Commission on Secondary Skills and America 2000 is to foster approaches to the education of our children that go beyond factual information to conceptual learning; beyond isolated rules to principles for application; and beyond textbook problems with known, predictable solutions to real problems with solutions that are unique to students and their interpretations of their resources and environments. Discussions of higher-order learning are not new. Bloom's taxonomy includes analysis and synthesis skills. Bruner describes "problem finding," and Gagné distinguishes problem solving and cognitive strategies as categories of learned capability; while constructivist thinking includes authentic, situated problem solving. Although abundant theoretical viewpoints exist, guidelines are still developing for designing teaching/learning strategies for ensuring higher-order outcomes in information literacy. The purpose of this paper is to (a) review characteristics of learning outcomes and environments that define higher-order learning in information literacy, and (b) describe some guidelines from two branches of cognitive psychology for designing information literacy instruction. The paper then closes with an appraisal of research trends and current practice in the teaching of information literacy.

Introduction

Schools used to have libraries with librarians. The general roles of the librarian were to manage a collection of print materials, promote reading and a love of good literature, and teach children how to find things in the library. Some librarians also kept track of filmstrips, slides, 16-mm films, audio tapes, records, and various projectors and players, although larger schools frequently had a person called an audio visual specialist who was responsible for maintaining, scheduling and circulating non-print materials and equipment. Teaching children to find information was limited to the card catalog for the print collection, a guide for periodicals, and standard print reference sources such as dictionaries, atlases, almanacs, thesauri, encyclopedias, and various books of people, quotations, places, and other things. Teaching children to find information in the library was circumscribed by the forms of information available, primarily requiring use of card catalogs, indexes, guide words, and alphabetical and numerical sequence to about the third character. Then a lot of rapid change began. In approximately a five-year period leading out of the 1970s and into the 1980s, we saw video disc and half inch videocassette appear; audio cassette started to replace records; school libraries, school librarians, and audiovisual specialists were replaced by media centers and media specialists; and micro computers showed up on desktops. The information age was beginning to touch schools and as formats and sources of information proliferated, the question in media centers changed from "How do I find information in a limited number of resources?" to "How do I choose information that is most appropriate for my needs from a seemingly unlimited number of resources?" Clearly this was a shift away from a focus on tool skills that were specific to a particular information resource, toward a focus on problem solving skills that would generalize across many information resources.

Problem Solving

Logical, sequential strategies for problem solving have been taught for years in virtually all disciplines. Although strategies may differ in detail, a common scheme might contain the elements depicted in Figure 1.

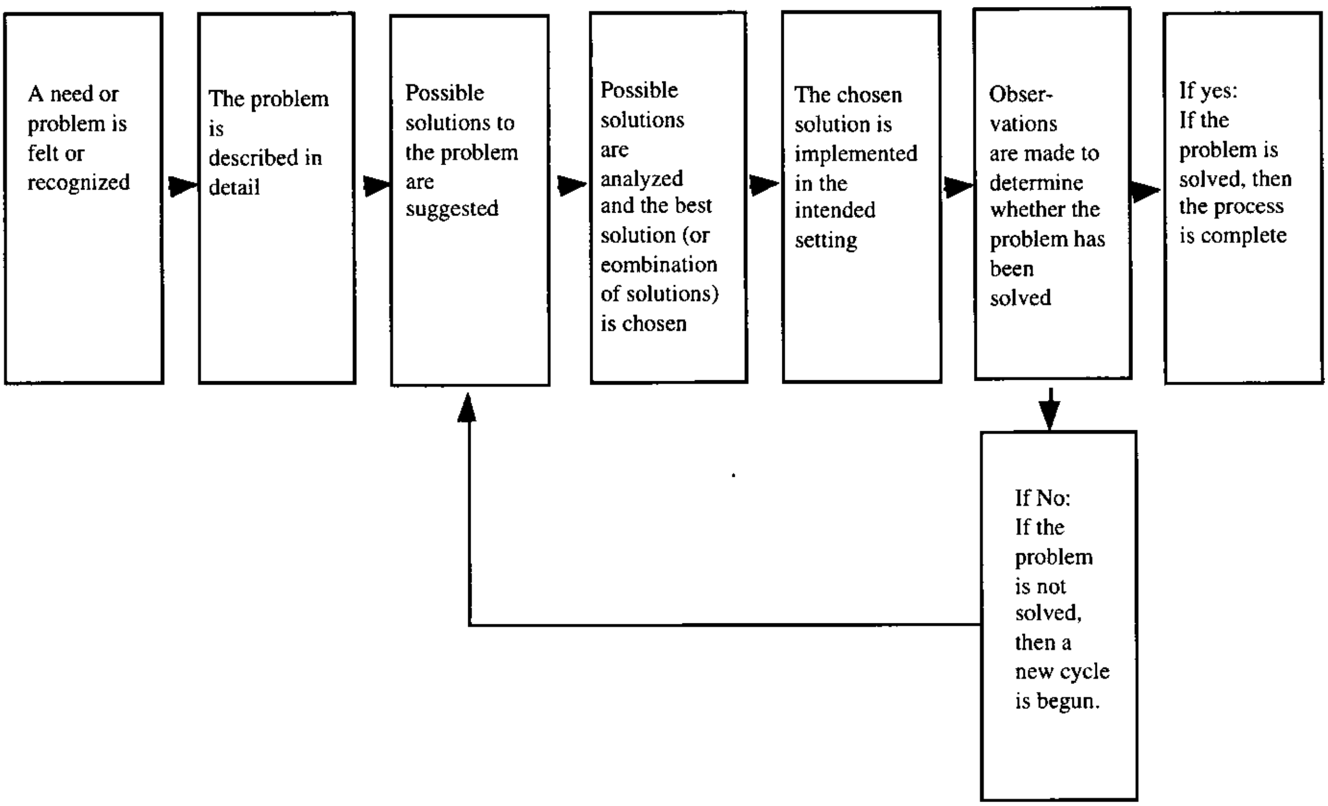

Figure 1. A Typical Problem-Solving Strategy

The elegance of such a process is that it has utility for all sorts of problems, so that once a process is learned and applied in one situation, a person has a mental strategy that could be generalized and used in any number of situations. For example, one can think through the steps in Figure 1 and imagine how they could be applied to these three sample problems:

- the use of water during the dry season exceeds the rate at which the aquifer is recharged,
- kids from the junior high school are smoking across the street in front of the elementary school, and
- what life is like for children my age in itinerant labor camps in central Florida.

Now for the sake of discussion, let us see if we can agree on several things: first, that these are all examples of problem solving tasks; second, that they would be appropriate problems to challenge school age children; and third, that learning to work through one of the problems should help a student who later decides to work on another of the problems. Agreed? Then what is it about this set of three problems that would lead us to characterize them as instances requiring problem solving capability? Though from different subject areas, the three problems have some distinct characteristics in common. First, regarding the nature of the problem itself:

- A key characteristic of problem-solving tasks is that they are what psychologists call ill structured (Spiro, Feltovich, Jacobson, & Coulson, 1992). That means that there is no single best solution inherent in the problem situation. Consider the case of using dividers and the scale on a map to work out a time-rate-and-distance problem, or using the drawing tools in PowerPoint to create a schematic representation of an electrical circuit. Both of these tasks would take some time, and a student would be using a variety of information, concepts, and rules to arrive at a correct answer. Both are worthwhile skills that could have many productive applications; but for the purposes of this paper, neither task is an example of problem solving, because both tasks have correct solutions that can be predicted before the task is even begun.

- A second key is that problem solving requires a lot of knowledge (in Bloom's definition of the term [Bloom, Englehart, Furst, Hill, & Krathwohl, 1956]) that is organized into very complex mental data structures called schemata (Rumelhart & Ortony, 1977). Students need a certain level of knowledge about subject areas in which they are working; and to function in a media center, they may need to know such things as general operating rules and procedures, the names and locations of resources, the function of bookmarks in Netscape, some sources that are good for specific reference tasks, the position of the printer switch for using the dot matrix printer, etc.

- A third key is that problem solving is complex, requiring students to bring many tool skills with them to the task, and probably to learn new tool skills in the process of problem solving. Tool skills include a variety of intellectual skills, attitudes, and perhaps some motor skills too. In a media center students need to use computers and software applications, employ Boolean terms to broaden or narrow a search, use a digital camera, write a paraphrase of an article, choose the most appropriate WWW search engine, find something of interest in the vertical file, etc.

- A fourth key is that problem solving requires a strategy, a collection of tactics that can be grouped and used in developing a solution. It may require brainstorming, developing a rating scale for comparing alternative solutions, holding a debate, rooting out primary sources of information and evaluating their authority, formatting a Gantt chart, testing a hypothesis, etc.

- The final key is that knowledge, tool skills, and solution strategies must be orchestrated into an effective process, recognizing that problems are not static; they are dynamic, changing as we work on them and learn more about them. To solve problems effectively we must constantly check and re-check assumptions, apply different sets of knowledge and tool skills, change or modify our solution strategies, and mentally monitor the problem-solving process to make adjustments and keep it on track as we progress toward a solution. This is variously referred to as using cognitive strategies (Gagné, 1985) and metacognition (Brown, Campione & Day, 1981) or just plain "learning how to learn."

I have described some characteristics of problem solving; now to finish this discussion, I want to mention two properties of problem solving activity that run throughout the literature on school restructuring and future schools. We read constantly that schools should be teaching children to <u>think</u> instead of memorize and repeat, and that thinking skills should <u>transfer</u> to the real world so that our children become independent, productive members of adult society. Problem solving as described above is the essence of thinking "skill" and if schools can provide the appropriate variety and frequency of problem-solving engagement, then transfer (in keeping with individual student's capabilities) will be assured. Figure 2 is a graphical representation of the foregoing description of problem solving.

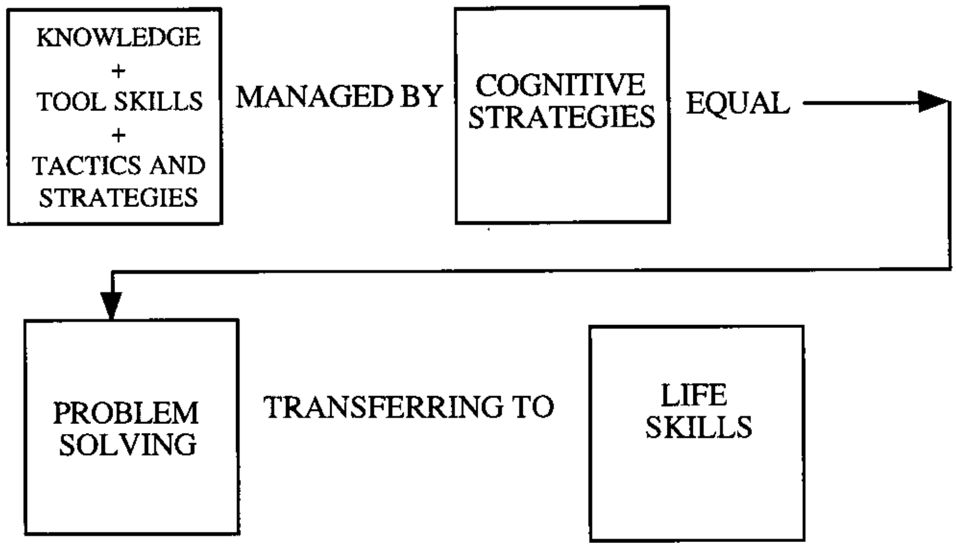

Figure 2. Problem Solving and Life Skills

Information Problem Solving Models

Within many disciplines, more specific problem solving strategies are developed so that practitioners need not infer from a generalized model to a context of particular interest. This is the case regarding information problem solving. There is a body of literature on information problem solving in school settings that began to gather momentum in the 1980s with definitional discussions, expanded into model building, and now, in the 1990s, has moved into qualitative (and some quantitative) investigations of: (a) the efficacy of models, (b) strategies for optimizing applications of models, (c) interactions among selected aspects of models, curriculum content, information resources, students, media specialists, and teachers, and (d) the application of appropriate theories from communications, information science, and cognitive psychology. It is not my purpose to review this literature here. The authors and their lines of research can be tracked through the last 10 to 12 years of *School Library Media Quarterly* and *School Library Media Annual*, but as a point of reference for those who may not be familiar with this literature, a representative information problem solving model, The Big Six Skills Approach (Eisenberg & Berkowitz, 1990, 22-24), is included below.

1. Task Definition: (determining the purpose and need for information)
- 1.1 Define the problem.
- 1.2 Define the information requirements of the problem.

2. Information Seeking Strategies: (examining alternative approaches to acquiring the appropriate information to meet defined needs)
- 2.1 Determine the range of possible resources.
- 2.2 Evaluate the different possible resources to determine priorities.

3. Location and Access: (locating information sources and information within sources)
- 3.1 Locate sources (intellectually and physically).
- 3.2 Find information within resources.

4. Use of Information: (using a source to gain information)
 4.1 Engage (e.g., read, hear, view) the information in a source.
 4.2 Extract information from a source.

5. Synthesis: (integrating information drawn from a range of sources)
 5.1 Organize information from multiple sources.
 5.2 Present information.

6. Evaluation: (making judgments based on a set of criteria)
 6.1 Judge the product (effectiveness).
 6.2 Judge the information problem-solving process (efficiency).

My purpose in mentioning this literature is to emphasize that serious efforts have gone into building and testing models of information problem solving, and to point out that these models depict processes that share the features and characteristics of problem solving that I have described earlier in this paper. Granted, the focus of the models is strategies for solving information problems, but the models retain that critical property of transfer; that is, once a student has sufficiently broad experience with an appropriate range of problem environments in school, then the student will be equipped with mental strategies that can be applied in future levels of schooling and in many kinds of life situations.

Teaching Problem Solving

The purpose, of course, of theorizing, building models, and conducting research in problem-solving processes is to inform our practice of teaching. Table 1 is included here to focus some of the previous discussion of problem solving on the question of teaching, and to provide an organizational pattern for the rest of this paper.

Please note one thing first about Table 1. The terms *Library Skills*, *Information Skills*, and *Information Literacy* were chosen as convenient labels rather than with regard for their current usage in the field. Their inclusion in the table does not suggest that they are, or should be, operationally defined according to their usage here. A second note about Table 1 is that the organization of the table is not intended to marginalize the value of library skills or information skills, as I am convinced that both are indispensable components of information literacy. A final caution: although facilitating discussion, the design of Table 1 makes the entries in each column appear to be conceptually discrete, while the entries are really more continuous, blending from one row into the next.

Now the focus of the paper shifts to consideration of what two theoretical positions in learning psychology have to say about how we should design instruction for teaching problem solving. The discussion will be organized using column 5 of Table 1, looking first at cognitive objectivists' views, then cognitive constructivists' views, and finishing with an analysis of a middle ground that is probably most representative of current thought.

Table 1.
Teaching Problem-Solving Skills in the School Media Center Context

TYPES OF SKILLS	COMPONENT OF PROBLEM SOLVING (FROM FIGURE 2)	TEACHER'S ROLE	STUDENT OUTCOMES	PSYCHOLOGICAL FOUNDATION
Library Skills	Knowledge and tool skills	Teaching sets of tools for accessing, manipulating, creating, and reporting information in a variety of formats	Students find information from multiple sources and use it in preparing reports and presentations	Cognitive objectivist
Information Skills	Tactics and strategies	Teaching library skills and a process by which students can be guided in their solution of information problems	Students apply a generic solution strategy to a variety of information problems, and construct new meaning through the interaction between what they already know and the new information that they encounter	Cognitive objectivist and Cognitive constructivist
Information Literacy	Cognitive strategies (metacognition)	Creating learning environments (problem scenarios) and cooperative group structures in which the natural outgrowth of curiosity is the collaborative construction among students of effective information problem solving strategies (facilitated as needed with library skills, and techniques such as modeling, coaching, and scaffolding)	Students construct personal solution strategies for information problems, and generalize, test, and adapt those strategies in new problem situations	Cognitive constructivist

Designing Instruction from the Cognitive Objectivist's point of View

Instructional design is what we most commonly associate with what has recently been labeled cognitive objectivism. Applications of instructional design in planning for teaching information skills are prescribed in *Information Power* (1988, 35) and have been explored most completely by Turner (1993). The term *objectivist* was actually added as a tag to the term *cognitive* by a constructivist (Lakoff, 1987) as a way of distinguishing different views within cognitive psychology. Cognitive psychologists believe that learning is an active mental process in which dynamic structures of meaning are created and modified as an individual interprets and acts upon the environment. Cognitive psychologists also believe that there is value in trying to understand how the mental processes of learning work, so that we can design instruction in such a way as to support best what is happening in a student's mind during teaching and learning. Both objectivists and constructivists are cognitive psychologists.

Many traditional instructional designers reject the label *objectivist*, because they do not subscribe to all of the assumptions implied by the term (Merrill, 1991). That said, I will go ahead and use the term here because it does denote the traditional instructional design view that the world has an "objective," real structure that does exist regardless of how different individuals may internalize and interpret what they experience. What that means in a practical sense is that knowledge and skills can be organized and categorized, and that relationships can be identified within and among categories (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Gagné, 1985; Dick & Carey, 1996). Thus state departments of education can produce curriculum guides and scope & sequence documents; media specialists can list the skills that they plan to teach in the information curriculum for the year; and teaching sequences can be identified based on procedural, logical, and subordinate/superordinate relationships among skills. Based on these assumptions, traditional instructional designers do their work as follows:

1. specify learning outcomes, usually in the form of goals and objectives
2. analyze the skills required to reach the learning outcomes, identifying sequential relationships among the skills
3. analyze the intended learners with regard to:
    - their mastery of skills that should have been learned prior to beginning the new instruction
    - their predisposition for learning, including: attitudes, abilities, achievement levels, physiological or psychological limitations, family support structures, etc.
4. specify instructional strategies (instructional events, materials, methods, and activities) based on learning outcomes, skills requirements, and what is known about the learners
5. select and/or prepare instructional materials
6. implement the instruction and evaluate the results
7. revise the instruction if needed to improve effectiveness, acceptability, or efficiency.

The fourth step, specifying instructional strategies, is also called lesson planning, and traditional instructional designers will typically stress inclusion of the types of instructional events listed in Attachment A, a sample skills lesson on learning to use PowerPoint. The lesson plan is an example of the way that instructional design has been done for about 25 years. It falls into the *Library Skills* category in Table 1, being used to teach knowledge and tool skills. There is no real point of discussion here concerning the teaching of problem-solving skills, except to point out again that knowledge and tool skills are a necessary component of anyone's problem-solving repertoire. Now let's skip to the bottom row of Table 1 and consider cognitive constructivists' views.

Designing Instruction from the Cognitive Constructivist's Point of View

The constructivist point of view is included in this paper because it is now specifically referenced in a current position taken by the American Association of School Librarians (1996) and a joint position taken by the American Association of School Librarians and the Association for Educational Communications and Technology (1996). Constructivism is also proposed as a foundational theory by several authors currently writing in the school media literature.

Jonassen (1992) describes a continuum of constructivist thinking, and places himself toward the radical end. Whereas objectivism assumes that reliable, structured knowledge about the world exists,

> Constructivism, on the other hand, claims that reality is more in the mind of the knower, that the knower constructs a reality, or at least interprets it, based on his/her experiences. Constructivism is concerned with how we construct knowledge from our experiences, mental structures, and beliefs that are used to interpret objects and events. Our personal world is created by the mind, so in the constructivist's view, no one world is any more real than any other. There is no single reality or any objective entity. Constructivism holds that the mind is instrumental and essential in interpreting events, objects, and perspectives on the real world, and that those interpretations comprise a knowledge base that is personal and individualistic. The mind filters input from the world in making those interpretations. An important conclusion from constructivistic beliefs is that we all conceive of the external world somewhat differently, based on our unique set of experiences with that world and our beliefs about those experiences. (pp. 138-139)

A maxim from the field of general semantics sums up constructivism pretty well; it says, "The same man can not step into the same river twice." The thought is that the reality of the river will have changed and so will the person experiencing the reality. Based on this thinking, one might conclude that the notion of constructivist instructional design is oxymoronic, a conflict in terms. If there is no objective reality and if students construct their own knowledge, then what is left for the instructional designer to do (Winn, 1993)? If learning is internal and individual, and therefore unpredictable, then how can instructional designers determine what students need, prescribe instructional activities, and assess learning outcomes? Rest assured that instruction will happen, and that it will occupy space in a school and take up time, so if nothing else, the school will require that it be planned. But what form will such plans take? As a reminder, our focus is now on the bottom row of Table 1, which places us into cognitive strategies for problem solving.

Before discussing design considerations for problem solving, it will be useful to read through the Scenario in Attachment B. It is a description of a problem solving task in mathematics. Does the scenario meet the tests of a problem-solving skill? The math problem requires knowledge and tool skills; it is complex and students will need to manage tactics and strategies to solve it. But is it ill defined; is there a correct answer inherent in the problem? If the answer of interest is the number of jelly beans, then this is a very defined problem; but if the teacher's real goal in the scenario is that students will construct problem-solving strategies, then it is an ill-defined outcome. Did the teacher in the scenario function as an instructional designer? Not in the traditional sense, but the teacher prepared instructional materials and followed a planned process in which student and teacher roles were carefully defined. A constructivist would say that the teacher had designed a *learning environment* (an engaging problem scenario), and that there are guidelines for doing that. In Table 2 I have used the framework of instructional events from Attachment A to organize a set of guidelines for designing constructivist learning environments to support students' learning of problem-solving skills. This framework of instructional events also provides an opportunity for comparison and contrast between objectivist and constructivist points of view. Two general conclusions from looking at the table are that constructivists must certainly do a lot of instructional planning and design to make instruction work, and both constructivists and objectivists would seem to want to get a number of the same kinds of things done during teaching/learning, but would go about it in different ways. The guidelines in Table 2 are a synthesis of ideas largely taken from Choi and Hannafin (1995), Savery and Duffy (1995), Kuhlthau (1993), and Stripling (1995). Now let us turn our attention to the middle row of Table 1, and consider a middle road of instructional design incorporating both objectivist and constructivist points of view.

Table 2
Comparing Traditional Instructional Design with Constructivist Learning Environments

Instructional Events from Objectivist Instructional Design	Guidelines for Designing Constructivist Learning Environments to Support Students' Development of Problem-Solving Skills
1. Provide a motivational introduction and focus students' attention on the important content that will be learned.	Foster motivation through "ownership" by giving students choices in the content they explore and control of the methods they use for exploration. Situate the problem in a meaningful (authentic) context that is rich in the content of interest.
2. Let students know what will be expected of them and remind students of relevant things they should already know.	Problem scenarios should emphasize constructing process over finding answers; for example, the aim is for students to think like mathematicians rather than to compute a correct answer. Scenarios should require reflexive thought, looking back to incorporate foundational knowledge in construction of new knowledge.
3. Present the new content and examples in ways that will enable students to learn and recall successfully.	Use cooperative learning so that students can negotiate the meaning of what they are learning. Design problem scenarios of high complexity requiring use of multiple process strategies and knowledge and tool skills. Encourage multiple perspectives and interpretations of the same knowledge Situate the problem in authentic contexts.
4. Provide students with opportunities to practice their new skills.	Problem scenarios must be generative rather than prescriptive; that is, students construct their own, active investigation and knowledge acquisition rather than following steps in a prescribed process. Encourage group participation for trying out and negotiating new knowledge and process.
5. Provide students with information about how well they are doing in their practice.	Balance the potential frustration of aimless exploration with just enough facilitation to ensure progress (suggested facilitation techniques include modeling, scaffolding, coaching, and collaborating), but fade the facilitation as students become more skillful. Facilitate group interaction as needed to ensure peer review of knowledge and process.
6. Provide review and relate the new skills to real-world applications and to upcoming lessons.	Students should have opportunities to explore multiple, parallel problem scenarios where they will find application in a new scenario of information and processes that they have previously constructed .
7. Provide tests, performance checklists, rating scales, attitude scales, or some other means of measuring mastery of the new skills in as authentic a setting as possible.	Suggest tools that students can use to monitor their own construction of knowledge and process; learning should be reflexive, encouraging review and critique of previous learning and newly constructed positions. Standards for evaluation cannot be absolute, but must be referenced to the students unique goals, construction of knowledge, and past achievement. The ultimate measure of success is transfer of learning to new, authentic environments.

Designing Instruction from a Combination of Objectivist and Constructivist Points of View

A useful understanding at the outset of this discussion is that some of the conflicts between objectivists and constructivists are more over the theory behind why things are done than over the actual things that are done in the teaching/learning process. This is probably true in most instances when an emergent position is being advanced in opposition to a dominant position by proponents seeking theoretical acceptance. I have included Attachment 3 as an example of what I would view as a combination of objectivist and constructivist lesson planning and management. This example is from Kuhlthau's (1993) description of a process approach to information problem solving. After reading through the scenario, you are invited to compare Kuhlthau's description of the teaching/learning process with the objectivist and constructivist views presented in Table 2. I think that you will note that Kuhlthau's approach is at the same time more prescriptive than the constructivist view and more student centered than the objectivist view. I think this is a result of the focus of the unit of instruction. My interpretation is that the goal of the unit was for students to learn to use a given problem solving process in their construction of new knowledge from a variety of resources. It appears that the approach to learning the problem-solving process is quite objectivist in its design, while the approach to learning from a variety of resources is quite constructivist. Had the focus of the unit of instruction been for students to construct their own information problem-solving strategies, then the design of the unit may have been quite different.

Research Trends and Current Practices in the Teaching of Information Literacy

Where is the field of school media with regard to teaching library skills, information skills, and information literacy? Figure 3 illustrates a continuum with indications of my personal estimation of where we are in practice and where we are in research/advocacy.

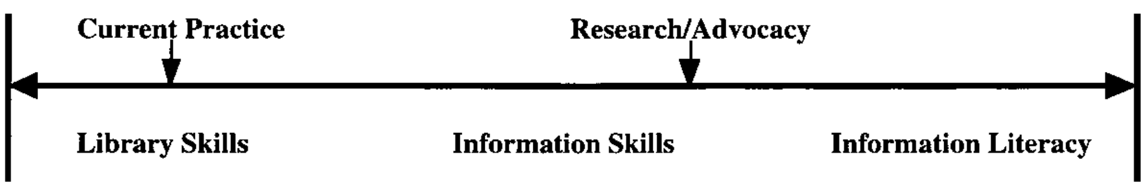

Figure 3. Status of Instruction in School Media Centers

My estimation of where we are in practice is based on the literature in our field, several years of LM_NET, and observations of media center programs in Florida, Ohio, and Arizona. With the constraints imposed on media specialists through staffing patterns, scheduling, and problems in breaking out of old perceptions of roles and responsibilities, it is difficult to bring together the cooperative arrangement among teachers, students, and media specialists that is required to implement a good information skills program. To that, add constraints imposed by state and district curriculum requirements, testing, and accountability standards, and for the media specialist to move toward a full-blown, constructivist, information literacy program becomes a task of enormous proportion. Even when states specify the desirability of information literacy, they typically prepare tests to measure it in ways that are at odds with constructivist theory.

My estimation of where we are in research/advocacy is based on my comparison between a constructivist view (the position of AASL and AASL/AECT) and current writing in our field on information problem solving. I see a constructivist trend regarding children and their learning of information, but not regarding children and their construction of cognitive strategies for problem solving. The Big Six Skills

Approach, Kuhlthau's process approach, and similar models for teaching information skills do contain some constructivist elements, particularly in the reflexive aspects of evaluating and "personalizing" the problem-solving process; however, current research/advocacy remains an objectivist/constructivist combination.

Several topical areas for discussion are suggested by this appearance of differences between the position of our professional organizations and current practices and trends our field. First, there may be some simple problems regarding the use of the term *constructivism* that could be resolved by efforts within our professional organizations to develop thoughtful, operational definitions with accompanying scenarios of how constructivist theory applies in our teaching of information literacy. Are our professional organizations really advocating a fully constructivist conception of teaching/learning, or is it more of a combination objectivist/constructivist approach? Discussion of this definitional question could raise a dilemma regarding theory and practice. Rethinking the constructivist position to accommodate the current combination of objectivist/constructivist methodologies would probably create some dissonance among theorists in our field; however, pushing the agenda toward a fully constructivist conception of teaching information literacy would probably create dissonance among practitioners in our field by driving the official position of the profession even further away from current practice. A second topical area for discussion concerns appropriate research methodologies for investigating applications of constructivist teaching strategies in the context of typical school media centers. Research in applications of models of information problem solving is well under way; perhaps this research could be expanded to include investigations of children's construction of their own strategies for information problem solving. Finally, if our professional organizations are intent on advocating a theoretical foundation for the teaching/learning that occurs in school media centers, then perhaps broader discussion of the question should be encouraged among the membership, and alternative views of theoretical foundations should be entertained.

Attachment A

LESSON PLANNER

Objective or Objectives: Students will work at a terminal in groups of three, and each student will complete a brief PowerPoint sequence that includes titles, bullets, sub titles, clipart, and a Microsoft draw object.

Notes: This is the first of 3 skill-building lessons in PowerPoint. Students will already have basic keyboard and mouse skills and familiarity with the Windows (or Mac) interface and basic word processing. Each student will be working on a report assigned by the classroom teacher.

Instructional Events	Media and Materials	Description of Instructional Methods, Activities and Student Groupings
1. Provide a motivational introduction and focus students' attention on the important content that will be learned.	-media specialist -computer w/LCD panel -beginning and advanced PPT projects from previous students	-demo for whole group -show some cool PPT presentations that students have produced as alternatives to pencil/paper reports -elicit ideas about different subjects that can be portrayed visually -point out that later in the semester they will be able to make their own WWW pages using PPT
2. Let students know what will be expected of them and remind students of relevant things they should already know.	-assignment sheet w/checklist -media specialist -computer w/LCD panel -beginning and advanced PPT projects from previous students	-put up the PPT interface and point out the interface conventions that they already know from word processing in their "Works" program -discuss the assignment sheet with some reminders about teamwork -highlight new skills in a couple of PPT sequences -mention that students will be checking their own work and point out checklist -preview the lesson guide in the flipbook
3. Present the new content and examples in ways that will enable students to learn and recall successfully.	-assignment sheet w/checklist -laminated flipbook -media specialist -computers	-try to group more experienced computer users with less experienced -hands on at the computers with students following step-by-step in the flipbook -circulate casually among groups to monitor and provide help
4. Provide students with opportunities to practice their new skills.	-same as in #3	-practice sequences built into flipbooks
5. Provide students with information about how well they are doing in their practice.	-same as in #3	-examples built into flipbook in form of screen prints -self-check and peer review with checklist -circulate among students answering questions and providing guidance as needed
6. Provide review and relate the new skills to real-world applications and to upcoming lessons.	-media specialist -computer w/LCD panel -beginning and advanced PPT projects from previous students	-summarize with a few PPT examples of what students' work should look like -brief demo of more advanced PPT shows that include transitions, builds, and imported graphics which will be covered in their next session
7. Provide tests, performance checklists, rating scales, attitude scales, or some other means of measuring mastery of the new skills in as authentic a setting as possible.	-students' classroom projects -rating scale that includes classroom teacher's criteria for students' reports	-review students projects after entire sequence of PPT lessons has been completed and students' classroom reports are completed -provide feedback on PPT presentation, focusing on how new skills and techniques were used to advantage in students' reports

Attachment B

A Scenario

The following scenario provides a window into a third-grade constructivist (in my mind) classroom. The teacher began the lesson with a Plexiglas box filled with jellybeans, which she had placed in layers separated by paper, suggesting that the children think of ways to figure out how many beans were in the box. The children were given unifix cubes to use as tools and were asked to record their solutions. After working in collaborative groups for awhile, they convened a "math congress" to discuss their ideas. A few children began by explaining that they were going to count the top layer, see how many layers there were, and then add them up. Another child suggested that the same strategy could be used to count the top layer if they counted the rows and looked at how many rows there were. Agreeing with this strategy, they began to count the beans in each row but then became confused whether some beans should be counted once or twice--once as a unit in the row, once to represent the number of the row. (This is a common confusion as children struggle to construct multiplication—entering with a unitary assimilatory structure they must grapple with a grouping structure in order to make sense of the task.) The teacher was non-committal; instead she simply facilitated discussion. After much debate, they resolved that issue explaining and proving their reasoning to the rest of the group, which concurred. For the top layer they produced an answer of 6 rows with 8 beans in each. The teacher recorded 6 x 8 explaining that mathematicians write the expression with an X to show groups and to differentiate it from addition and subtraction. Some children argued that from where they were sitting they saw 8 rows of 6. They counted to make sure it was still 48 and discussion ensued over whether the total answer would always be the same when the digits were reversed (the commutative property). After proving to each other that it would, by building several rectangles and recognizing the reciprocal nature of the columns and rows, they began to count the layers and over the next several sessions proposed short-cut addition strategies (involving the distributive and associative properties of multiplication) such as adding up two layers three times. After each session the teacher had the children write in mathematics journals their individual ideas so that she had a clear idea where each child was, and she wrote back, in dialogue fashion, in each journal asking questions. From this one problem the teacher engaged the children in investigating multiplication, its properties, area, and volume.

I share this scenario for several reasons. First, it shows an example of how a constructivist approach can be used with young children. Second, the teacher used no fancy, expensive technology but was able to capitalize on learners' initial conceptions and stretch them, letting learners put forth their own ideas and argue them within their learning community. Third, it suggests an avenue for assessment strategies. In a constructivist model it makes more sense (to me) to document learning, rather than to assess it. Portfolios of students' writing, mathematics problem solving, or recordings of science investigations can be kept, as well as individual journals and clinical interviews. Patterns of growth can be recorded using a developmental structural analysis. If needed, triangulation measures, ethnographic case studies, and interrater reliability measures can be used to document classroom learning and classroom interactions. Post hoc assessment measures which are conducted out of meaningful learning contexts test only the testers' question, and hence how learners take tests, rather than real learning.

from Fosnot, C. (1992). Constructing constructivism, pp. 173-4. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Attachment C

LIBRARY MEDIA PROGRAMS BASED ON THE PROCESS APPROACH

There are some general guidelines, however, for guiding students in the development of skills for seeking and using information in each stage of the information search process.[1] First and foremost, the process approach is initiated by open-ended problems, questions, or topics that need to be addressed by using a number of sources over a period of time. These open-ended issues arise directly from the curriculum to initiate problem-directed research, rather than artificially imposed research assignments that only peripherally relate to the context, content, and objectives of the course of study.

During initiation, an invitation to research is extended to students to prepare them for the creative process ahead. Some basic groundwork is laid to prepare students for the research process. An introduction such as a particularly gripping work of fiction, a vivid video portrayal, or an engaging speaker can capture the attention of students and enable them to form some basic constructs upon which to build. During this initial stage the students become aware of issues and questions worthy of further investigation and identify those issues that are of personal interest to them.

Brainstorming in the early stages draws out what students know and provides opportunities for generating, clarifying, and sharing ideas. Raising questions about their existing knowledge provides motivation for proceeding to find out more. An audience for their work beyond the teacher is established at the start. Brainstorming encourages collaborative learning at the very beginning of the process.

In the early stages, students concentrate on topics, ideas, and questions that need further investigation rather than getting enmeshed in the mechanics of the project. Mechanics are stated directly but in no way overshadow the central task of gaining a deeper understanding of a particular problem, issue, or topic. Keeping a journal is a useful strategy throughout the process and can serve a variety of purposes at different points. For example, at one point students use their journals to record thoughts on possible topics, plans for addressing the project, and prospective problems. Later in the process, they use their journals for detailed notetaking.

At the beginning, students are introduced to the concept of stages in the search process and become aware of what to expect in the ensuing project. The model of the information search process is used to illustrate the sequence of tasks, thoughts, actions, and feelings that are commonly experienced in each stage of the process. Students may refer to the model from time to time to determine where they are in the process.

After students have selected a topic or area for research, they are carefully guided and coached through the exploration stage. This is frequently the most difficult stage. Uncertainty prevails as students encounter information that is inconsistent and incompatible and does not match what they already know. Reading and reflecting in a receptive mood and in an unhurried environment are conducive to formulating new understandings. Opportunities for discussing newly formulated constructs are offered through one-on-one conferences, small group interaction, and large group discussions. Journals are helpful for recording interesting ideas, connecting themes, and emerging questions developed from a number of sources instead of extensive copious notes from one source. This activity also deters students from the tendency to copy word-for-word or to plagiarize when presenting.

Students gain a clear understanding that their task during this time is to form a focused perspective of their topic or problem by reading, investigating, and thinking. A focused perspective provides direction for collecting information and is the turning point of the information search process. Once a focus is formed the search takes on a central theme or guiding idea that provides the basis for making judgments of what information to collect and what to disregard. Notetaking strategies shift at this point to recording detailed notes on information related to the focused perspective of the topic.

The final stage is organizing ideas for presentation. Students are guided in determining what will be paraphrased, summarized, and quoted and how to document the origin of the information used. Connections are made between and among the ideas and extensions of meaning are identified and explained. Presentations take many forms and are addressed to the collaborative learning group, not solely to the teacher.

[1] Carol C. Kuhlthau, *Teaching the Library Research Process*, 2d ed. (Metuchen, N.J.: Scarecrow, 1994).

An essential part of the process approach to information skills is assessing the process as well as the product at the end of the project. An opportunity to look back and take account of the entire process enables students to recognize that their experience has not been isolated to this one incident but is applicable to a wide range of situations. Journals provide an excellent means for students to review their process. By reflecting on their use of time, use of sources, and evidence of a focus in their presentation, they develop an awareness of their own information search process. "Processfolios" of student work representing the various stages of the project provide an excellent way to assess the process of learning.[1]

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Biographical Notes

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I am currently an Assistant Professor in the School of Library and Information Science at the University of South Florida, and have prior graduate-level teaching experience at Florida State University and Arizona State University. I specialize in teaching courses in computer applications in libraries and information centers, communications technology, educational technology, instructional systems, and school media center management. I also coordinate the School's television and Internet-based distance learning initiatives. In addition to my academic experience, I have worked in secondary schools as a teacher and technology specialist and have held a variety of consulting and management positions in the public and private sectors. My current projects include analysis of school media specialists' roles and responsibilities, assessment of students' academic motivation in traditional and distance learning environments, and design and development of computer-based electronic performance support systems.

I worked in the private sector for a number of years before coming to South Florida. TM6 was the first research conference that I attended after rejoining academia, and it was exciting to spend several days with smart, motivated professionals whose "bottom line" is successful children. Important ideas were presented and discussed with insight and humor. People were great! I look forward to TM7.

Consider the Source

Regina B. Moody

Abstract

This paper focuses on the process of locating, interpreting, and evaluating information **within** sources, and suggests methodologies for classroom teachers and school library media specialists to use while instructing and coaching. Whereas it is widely accepted that students must be taught how to search for and gather information in print indexes, library catalogs, and electronic sources, the skills required for strategic and critical reading, listening, and viewing are less clearly understood.

Consideration is given to the students' need for distinguishing types of writing, and to their understanding of the external and internal organization of expository text. Although primary attention is given to paper or electronic print sources, the ideas presented relate as well to all media. The article advocates altering or modifying inquiry strategies to meet the demands of the material being examined. Suggestions are included to assist the learner in developing skills for assessing the usefulness and/or value of information or ideas embedded in a source.

Introduction

Instructional interventions include facilitating, prompting, coaching, guiding, and teaching by direct instruction. No matter which term most clearly applies in a particular situation, the development of instructional partnerships between elementary classroom teachers and the school library media specialist should have student learning as the central goal.

To be effective, classroom teachers must develop new insights and skills. They need to learn about their school media center's collection, about the organization and access features of particular sources, and about the information search process itself. When they were children, veteran teachers most likely did not attend schools that had libraries, or they experienced storytime-centered ones. Teachers newer to the profession may remember "library skills" scope and sequence charts in which small check-off blocks were used to indicate superficial knowledge of encyclopedias and the card catalog, as if they were **single** skills. Teachers cannot be expected necessarily to have a firm grasp of school library resources and of the complex skills required for extracting and evaluating information and ideas. "Inquiry" only recently has become a theme in teacher training programs and the particulars of the search process have had limited coverage even there.

School library media specialists, too, must continue to learn because, in domains of information and media literacy, they must function as master teachers. To be effective, instructional practice must be informed by knowledge about learning theory, about reading comprehension, and about the organization and presentation of ideas and information. Professional development requires keeping up with research from allied disciplines and seeking ways to integrate new insights into media center practice.

If school library media specialists truly are concerned with teaching students to analyze, synthesize, and integrate new knowledge, they must practice these skills themselves, and support teacher colleagues in their efforts to do so, and together, develop a common language of inquiry along with methodologies for building such competencies in students.

For more than three decades, principles of effective teaching for the learning of new skills have been widely accepted:

- Learners need to be successful with a new task.
- Learners need an explicit explanation of the skill and of its potential usefulness.
- Learners need to see a skill modeled and hear the procedure articulated.
- Learners need supervision in their early efforts to apply a new skill in order to insure that correct habits are being formed.
- Learners need much practice along with immediate feedback.
- Learners do best when tasks or concepts move from simple to complex.

In addition to holding this well established model, there are those who advocate a more constructivist view of learning through which experience as an inductive process leads to recognition of patterns.

No matter which principles are accepted theoretically by the teacher, too often when it comes to research assignments, these principles are disregarded. Elementary age students, for example, may be assigned search tasks ranging from locating single facts, to locating and synthesizing information from multiple sources with little more than the directive, "Write a five-page report in your own words."

Lessons and experiences can be designed by the classroom teacher and the school library media specialist so that each subskill in the information search process is introduced and practiced with confidence and success (Generally, students in third grade are ready for such instruction). Concepts and skills relating to extracting, analyzing, and determining information relevance--the **central** portion of widely-accepted information process models--are the focus of this paper. Using what have become known as "authentic literacy tasks," it is not too soon for teachers, school library media specialists, along with their students, to begin to speak a common language of inquiry and, together, learn to effectively **consider the source** in hand while applying critical thinking and reading skills.

Understanding Types of Writing

The terminology for distinguishing types of writing varies. The beginning reader may first be exposed to "narrative" (story) text structure. Later, students may be asked to read and write "descriptive" and "persuasive" passages. In early writing assignments, compositions are often referred to as "creative writing," no matter the content.

In their early elementary school years, students have fewer experiences with informational, or "expository" text, and with the reading strategies that these texts require. When they are introduced to such writing, it is generally through brief paragraphs reproduced on work sheets or in simple nonfiction books having limited text. Teachers tend to refer to these passages as, e.g., "stories about volcanoes," although the term, story, more accurately describes narrative text.

Young students may be confused by terminology such as declarative and procedural knowledge, modes of discourse, persuasive and descriptive expository writing. By upper elementary grades, however, such terms should be used by the teacher and school library media specialist to help students develop precise language and concepts for further elaboration as they mature.

Understanding Expository Text Organization

Authors attempt to write so that their ideas are readily accessible to the reader. They employ external as well as internal structural features to facilitate comprehension of the information. As obvious as it may seem, students must be assured that the writer was a real person whose objective in writing was to communicate meaning, and not to confuse or overwhelm the reader. Students then can be taught strategies to recognize and use text organization to aid in their comprehension and retention of what is read. At the same time, students can be taught to recognize poorly written material that lacks coherence and to realize the necessity for their mentally reorganizing the information into some more reasonable form to make it useful (Calfee & Curley, p. 164).

Text structure can be differentiated according to the external and the internal organization of information. Whereas external features obviously vary with source formats, internal organization remains fairly consistent across types of media.

External Organization

Researchers have referred to external organization variously as "format features," "information-access features," and "organizational aids." Although terminology differs, there is agreement that this visual organization, or structure, is intended to facilitate effective reading. With regard to books, school library media specialists customarily speak of these structures as front and end matter. Front matter includes the preface, table of contents, title page, dedication, and lists of tables or illustrations. End matter encompasses appendices, the glossary, bibliography, and index.

Magazines and newspapers have unique design and layout features which may be obvious to adults, but not to elementary age students. Instruction about text organization should include comparisons of typefaces, multiple column formats, and ways of citing authority or authorship across print media.

Electronic media require special attention by students when they consider how the information has been organized and communicated. Screen design and display are intended to facilitate use, but can sometimes frustrate the young viewer. The significance of "media psychology" is recognized increasingly by educational software designers who are concerned with product use and effectiveness (Luskin, p. 82). The proliferation of Internet web pages has brought graphic options and layout decision-making to ever younger designers. Experiences with production may sensitize students to examining the "navigational tools" others have developed. Whereas in books, introductions and chapter headings may be skipped or hastily noticed by the reader, with screen text, which tends to be divided into smaller logical units, readers may utilize these guides more readily in order to access and understand the material scrolling past. Generally, upper elementary age students seem comfortable with the variety of screen protocols and switch easily between differing menus and on-screen commands.

Publishers of children's materials have come a long way in developing visual appeal and clear delineation of text. Type size and font, margin widths, and placement of text and graphics are carefully planned for widest appeal. Nevertheless, children are done a disservice if they are not taught how to examine an earlier copyrighted publication for its usefulness even if the book has a dated appearance. To be exposed primarily to slick text and glossy image ("sound bites" of information) limits the development of those skills of discrimination and judgment that are informed by content. One wonders if all the accumulated wisdom on the shelves of libraries will have to be repackaged in Mylar and high tech formats in order to merit consideration. There **are** still those, however, who pass on the admonition to avoid judging a book by its cover--or design features.

Internal Organization

Within text passages--sections, chapters, etc.--authors work to connect their ideas logically depending on their informative purpose which may be to tell, describe, show, explain, or persuade. The relationship between printed headings, subheadings, and the actual passages should make sense. Information is more easily understood if it is presented in an organized manner. Often an author chooses to organize ideas in a hierarchical relationship using the most important ideas at the top level of the content structure, followed by supporting ideas and details. Students can be taught to anticipate such a structure and to look for the major thought relationships.

There is inconsistency among educators and researchers in their delineation of the top-level structures, semantic patterns, or rhetorical styles found in expository writing. Some refer to "enumeration," "time order," "comparison-contrast," "cause-effect," and "problem solving" as the basic structures (Vacca & Vacca, 1989, p. 186). Others have used the terms, "description," "collection," "comparison," "causation," and "problem /solution" (McGee & Richgels, 1985, pp. 741-42), or "description," "collection," "comparison/contrast," "antecedent/consequent," and "problem/solution" (Calfee & Curley, p. 167). Still others distinguish six rather than five basic patterns, " *descriptive*," "sequence," "process/cause," "problem/solution," "generalization," and "concept patterns" (Marzano, p. 42). No matter which terminology is adopted by a particular school, there should be common agreement on usage among teachers and the school library media specialist in order to avoid confusing the students.

Students can be taught to look for clues or explicit signals within text that help them distinguish an author's thought structure. These "connectives," so called by linguists, include such words and phrases as "to begin with," "finally," "for instance," "now," "on the other hand," "yet," "consequently," "thus," etc. (Vacca & Vacca, p. 189). Students must not expect, however, all text to be written in perfectly identifiable, consistent patterns. Expository writing can be quite complex with authors moving among patterns and embedding their ideas in syntactic and stylistic variety. Young readers must learn to perceive and use whatever structure is present, and compensate for or disregard poorly designed text that is unclear.

Using Text Structure

External Organization

When examining books, magazines, newspapers, or screens with students, teachers and school library media specialists can routinely articulate the value of using external organization features by **previewing** tables of contents, chapter or section introductions, summaries, and any other features that give a sense of the scope and presentation of the content. Instructors should model for students the kinds of questions that can be raised about an author's sequence in conveying ideas, point of view, and inclusion or omission of certain information. Such modeling will help students predict important material that may be covered in what they read. It may also help them identify places in the text where an author's point of view could be biased. Other organizational devices for students to preview include typographical and visual aids such as typeface of headings and subheadings, italicized words, pictures, diagrams, captions, charts, tables, and graphs. Increasingly with Internet sources, the viewer is also challenged to make distinctions between content and advertisement.

The initial previewing of a source is a behavior that needs constant reinforcement so that students do not simply jump into a passage and plod away sentence by sentence, often missing the forest for the trees. With lengthy encyclopedia articles, for example, it is not uncommon to find elementary students starting to read somewhere in the middle of an article because they have not identified the entry point, much less noticed any division of the content into sections. If their subject appears as a guide word, or an accompanying illustration is eye-catching, they often assume that the article begins there.

Effective **skimming** techniques should also be taught to students. Skimming is an intensive method of previewing actual content. Students need to be shown that time can be saved by reading the first sentence of paragraphs as well as then zipping through the material to get a general understanding of what it is about in order to make preliminary judgments about the material's relevance to their topic or question.

Internal Organization

The recognition strategies for perceiving internal structure place greater cognitive demands on the young learner than do external structures. Whereas there is agreement by researchers that students benefit from recognizing and using patterns of text organization, there is no clear agreement on a taxonomy of such prose structures. Before the teacher introduces any specific text structure, some researchers suggest first presenting the general concept of structure, differentiating it from content (McGee & Richgels, 1985, p. 740). Whichever instructional sequence is adopted, we must make clear to students through our common inquiry language that **content** is the information, facts, and ideas while **structure** is the writer's scheme for organizing that content.

Effective learning begins with students identifying one or two internal text structures (listing, sequence, comparison, etc.) then adding others as their understanding and confidence increase. Text selected for illustrative purposes should have a single predominant pattern over long passages even though individual sentences and paragraphs may show varying thought relationships. For elementary students, the most appropriate passages to use are those in which the text is organized around main ideas explicitly stated in each paragraph and in which hierarchical relationships are clearest. The problem/solution structure is a logical choice for early examination because it is thought to characterize many social studies textbooks.

The teacher or school library media specialist must do more than simply name an organizational pattern and tell students, to, for example, "look for sequence," or for "cause and effect." A particular pattern must be presented, discussed, and the author's meaning interpreted. By doing so, a deductive process is introduced and results in the students' actually seeing or experiencing how information fits together. The use of graphic organizers for each of the organizational patterns can help some students visualize the relationship of ideas. Other specific instructional techniques for developing these skills appear in McGee & Richgels (1985), Piccolo (1987), Richgels et al. (1989), and in Vacca & Vacca (1989).

Other Design Concepts

In helping students understand and process expository text, there are issues that influence the reader in addition to structural form. Calfee and Curley (pp. 175-77) suggest becoming familiar with other design concepts: "topical focus" (What is the piece about?), "structural formality" (What is the style relative to purpose and projected audience?), and "degree of elaboration" (What is the level or amount of discourse?). Thus, the student becomes cognizant of how expository text is constructed. "The author makes a series of decisions in creating a text; the reader's task is to retrace that path to the level of detail appropriate to his needs" (Calfee & Curley, p. 177).

School media specialists who know their collection well and who preview new acquisitions with an awareness of both external and internal text structure can be of invaluable service in suggesting to the classroom teacher materials both useful for developing pattern recognition skills, and for distinguishing content variation and stylistic features using agreed upon common inquiry language for instructional effectiveness.

Strategic Reading and Text Search Efficiency

Writers who discuss the teaching of reading in content areas have advocated, for every grade level, that explicit instruction be given in **how to learn from text** (Dishner, Pressley, Vacca & Vacca). Focus should be on how to acquire information and, simultaneously, on the information itself. As students become competent readers and mature in their metacognitive abilities, however, they must make a transition from teacher-centered guidance, teacher-created graphic organizers, and teacher-made pattern guides, and move into an awareness of and regulation of their own reading behavior (Beyer, Dishner, Feathers).

Young people benefit from internalizing the concept of what it means to be strategic (Duffy, p. 231). Elementary age students are bombarded early on with rules and strategies for use in their reading textbooks. The school library media specialist can reinforce the idea that the work of the learner is to construct meaning from anything read, listened to, or viewed. This often may require that the student adjust inquiry strategies to meet the demands of the material.

Students can be helped to make a distinction between reading skills and reading strategies. ". . . How one makes predictions differs from text to text depending on the clues available, the way to figure out the meaning of a word from context depends on the available clues, and the way to draw conclusions depends on the interaction of available clues and the reader's prior knowledge" (Duffy, p. 232). To comprehend and learn from an author's message, students must become consciously and flexibly strategic; they must become metacognitive readers (Duffy, p. 233).

In developing such discrimination, it is obvious that the school library media specialist cannot be the student's reading teacher and that he/she cannot be expected to identify and correct all the reading difficulties of a student. Nevertheless, knowledge of the process and having a shared vocabulary make for more credible collaboration with classroom teachers and promotes an effective school-wide learning environment for students.

Role of the School Library Media Specialist

It is appropriate for the school library media specialist to make instructional interventions that facilitate the student's ability to locate information within a text at those times when they are together. It is important to understand that extracting and interpreting information imbedded in extended text involve cognitive processes that are related to, yet distinct from, those in reading for comprehension and recall. Extraction and interpretation focus the student's attention on specific sought-after information and involve a more selective sampling of text. Several researchers have characterized this as a problem-solving process and have developed a "cognitive process model of text search." Guthrie and Dreher (In Nix, 1990) enumerate text search routes as follows:

> Students must decide what the needed information is (*goal formation*), determine which subset of the available chapter they need and locate pertinent sections of the text material (*category selection*), interpret and transform the available information (*element extraction*), remember or record the extracted information, and combine individual pieces of information with prior knowledge (*integration*) in order to infer and explain the relationship among the pieces of information. They must also repeat these steps to develop a complete set of information needed for constructing an answer (*recycle*). (pp. 98-99)

A later model from the literature adds the concept of "abstraction," or the understanding of non-prose features such as graphs, tables, and illustrations (Symons & Specht, p. 268).

For young students, the Guthrie and Dreher "search routes" translate into having the question or purpose clearly in mind, previewing the source to notice its external organization, selecting an appropriate reading speed for skimming, searching quickly through irrelevant information, and slowing down after detecting possibly relevant portions of text in order to consider their usefulness. Learning to plan an approach based on initial previewing and awareness of text structure will help the student sample fewer pages (or categories of text) before deciding that the target information is not in a particular location. As information is extracted, facts and concepts must be integrated in an ongoing process to satisfy the search goal. Until this is accomplished, the student must remember, or be reminded, to recycle through the text (or texts) and consciously monitor for completeness of information or until making a decision to stop (Guthrie & Dreher, pp. 96-98).

To date, research has centered on locating information in documents, textbooks, and electronic encyclopedias. Less is understood about students' searching in the large bodies of text found in informational books, articles, etc. A more generic process, *Student Model for Examining an Information Source,* is proposed by the author of this article. (See Figure 1 on the next page.)

Summarizing Information

Instruction on how to summarize increases students' comprehension and recall no matter through which medium information is obtained. There are numerous techniques in the literature for teaching summarization but the following simple, four-rule procedure provides a straightforward approach.

- Identify main idea (also, invent or state an inferred main idea)
- Delete trivial information
- Delete redundant information
- Relate main and supporting information (Pressley, p. 62)

It is important that the student learn to do this as a mental exercise, holding as much of the information in short-term memory as possible. Constructing a **written** summary is a complex metacognitive process that may not be mastered until high school or beyond. Young students tend not to condense a text passage but to retell it. As summarization procedures are modeled with children, there is ample opportunity to discuss other reading strategies such as predicting, questioning, making connections, and drawing conclusions--strategies that are important to any examination of content.

Evaluating Information

"Critical thinking" is a concept that has a variety of definitions. Its most basic meaning is the judging of authority, worth, or accuracy of a piece of information, assertion, or idea (Beyer, p. 33). It involves analyzing and evaluating objectively. It is more than a sequential set of operations like the "thinking strategies" of problem solving, decision-making, and conceptualizing. Rather, critical thinking is more like a collection of operations that may be used alone or in combination. Of the numerous lists of major critical thinking skills, Beyer's is clear and inclusive (p. 27):

- Distinguishing between verifiable facts and value claims
- Distinguishing relevant from irrelevant information, claims, or reasons
- Determining the factual accuracy of a statement
- Determining the credibility of a source
- Identifying ambiguous claims or arguments
- Identifying unstated assumptions
- Detecting bias
- Identifying logical fallacies
- Recognizing logical inconsistencies in a line of reasoning
- Determining the strength of an argument or claim

It is apparent that elementary age students cannot be expected to have the cognitive sophistication to comprehend fully each of these elements; they should, however, take the first steps toward understanding. To that end, teachers and school library media specialists must plan to introduce these thinking skills, which are the basis for critical evaluation in adult life.

Just as the critical thinking skills rubric parallels "information literacy," so, too, does it parallel "media literacy"--the consideration of mass communication print, film, and broadcasting. Media education projects generally are concerned with the development of discriminating audiences who can clarify media structures, content, and message rather than remaining passive and non-selective consumers (Beyer, p. 5).

A particularly helpful, simply stated evaluation checklist for young people comes from Boe's manual on responsible use of the Internet. It encourages critical analysis of information with this admonishment: "When it comes to the power of electronic media--it is important to become a savvy interpreter of information" (Boe et al., p. 52). The manual's authors further state that the five issues used in evaluating the ideas of others apply to one's own writing as well as to judgments about media: consider believability, authority, evidence, support, and logic.

The school library media specialist and teacher, by adapting curricular materials generated by media literacy organizations, can help students understand that the common objective is to become **learners** (readers, listeners, and viewers) who engage their minds and make reasoned assessments while maintaining individual autonomy and personal freedom (Brown, p. 22).

Age-Appropriate Search Assignments

As with any skill, facility is acquired through practice. Guided practice in locating information within text must precede independent practice. It is important for young students to work with a single source until basic concepts are established. Comparing two sources precedes using multiple sources. A teacher may think that assigning elementary age students topics "of their own choice" to research is a motivating activity, but it has much potential for frustration and failure. School library media specialists can help educate teachers about a developmentally appropriate research taxonomy (Stripling & Pitts) that is based on the cognitive readiness of young people. Even upper level elementary students are apt to expect a direct match of their inquiry question with the targeted text. They must be helped to understand that although some questions can be easily answered in a single sentence or paragraph, others will have "answers" scattered through the text--answers that must be assembled in order to construct meaning. Some questions will have only implied answers. And some questions will have partial answers found in multiple sources that must then be synthesized. Whether a particular search task is characterized as a "sharp problem" or a "fuzzy problem" (Guthrie & Dreher), students can be instructed to examine their question and to anticipate the form an answer will take as well as the process needed to achieve it.

Final Considerations

Other skills that facilitate a deeper understanding of and learning from expository text and that may be reinforced by the school library media specialist include reading graphic materials, outlining, paraphrasing, and note taking. Any of these skills can be monitored and refined as students work with resources in the library and beyond.

Our common wish for all our students is that they become confident readers, critical viewers, and active learners who take information and construct personal knowledge with understanding. We as educators must stay informed about research that investigates the processes of previewing, planning, and extracting information regardless of format. Providing effective interventions based on new and emerging understandings, and supporting young people as they progress toward the goals of true literacy is our challenge as teachers and as school library media specialists. We concur with author Beatrix Potter when she has a determined porcine character, Aunt Pettitoes, proclaim, "Attend, Alexander! Attend!" Yet, in this we speak not only to our students, but to ourselves.

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Author Biographical Notes

Regina Moody is the school library media specialist at Brennen Elementary School in Columbia, SC, where she has served for over twenty years. As a practicing, building-level media specialist, she has designed and implemented an information literacy program with her faculty. Moody is the author of *Coming to Terms: Subject Search Strategies in the School Library Media Center* (Neal-Schuman, 1996), and On the process of inquiry: a synergy of teacher, school library media specialist, and student. *School Library Media Activities Monthly*, 14 (September, 1997), 31-34. She is active in district and state professional organizations and has been engaged for workshops and presentations to educator and parent groups.

Moody combines her love for and knowledge of children's literature with her ever increasing responsibilities for instructional technology within the school. She continues to advocate the necessity for developing critical examination of information and ideas. Helping students develop skills for video production and electronic presentation to communicate their learning is a current focus of her work.

Interventions That Facilitate the Information Research Process with Low-Achieving Freshmen Using Kuhlthau's Six-Stage Model

Linda de Lyon Friel

Abstract

A process approach to teaching library and information skills has emerged, and with it, students are becoming information literate and capable of recognizing information needs, locating information, evaluating, synthesizing, and then using that information effectively. With emphasis placed on the process and the development of transferable cognitive skills, students' use of information hopefully will increase, thereby helping those students to become lifelong learners.

Introduction

This study examined a class of 17 low-achieving freshmen as they experienced the information search process. One focus was on the extent to which the students were able to move through the predictable thoughts, feelings, and actions described in Kuhlthau's six-stage information search process model (1983). The second focus was on appropriate and timely interventions into the process by the media specialist that facilitated the students' movement through the process. The use of interventions, including "warmth seminars" based on Mellon's research (1984, 1986) and student-media specialist interactions were recorded and analyzed.

The findings indicated that frequent and early interventions by the media specialist, especially one-on-one conferencing, helped to bridge the gap between actual and potential developmental levels. These interventions assisted students and resulted in an altered process, as well as in successful student learning experiences.

The Problem

As the amount of knowledge available today expands exponentially, it is becoming increasingly important for students to become information literate--to learn how to learn or process information. Information literacy involves the ability to recognize the need for information, as well as the ability to locate information in all formats, evaluate, and then use the needed information effectively (*American Library Association Presidential Committee on Information Literacy: Final report*, 1989, p. 1).

One challenge facing educators is how to prepare students to use the multitude of information that is now available. As education changes, there is a push toward resource-based learning, as opposed to the traditional and nonflexible textbook-based learning of previous years. Today's media center is the information center of the school and an extension of the classroom, and the school library media specialist has a unique opportunity to help schools meet the educational challenge of the information age.

Instruction in library and information skills is one of the primary functions of any school library media program and is supported in the mission statement of *Information Power: Guidelines for School Library Media Programs* (American Association of School Librarians, 1988, p. 1). The mission is "to ensure that students and staff are effective users of ideas and information," and objective one is "to provide intellectual access to information through systematic learning activities which develop cognitive strategies for selecting, retrieving, analyzing, evaluating, synthesizing and creating information at all age levels and in all curriculum content areas."

This vision of the school library media program includes, first and foremost, a process-oriented approach to research, and the role of the school library media specialist encompasses that of facilitator, coach, and mediator. The term mediator can be applied to any person who intervenes into the search process of another and can include both formal mediators such as teachers and librarians, and informal ones, such as friends and family members. These formal mediators are professionally responsible for intervention such as reference assistance or planned instruction (Kuhlthau, 1983, p. 121).

A process approach to teaching library and information skills and the information research process has slowly emerged. Yesterday's source-oriented approach to teaching library skills that concentrated on finding information, rather than on the process of seeking, using, evaluating, and then applying that information to problem solving, has largely been abandoned. Library skills can no longer be successfully taught in isolation from subject context and outside any logical, organized curricular framework. This process approach can be used in any library or media center, and "the emphasis is on developing transferable cognitive skills that should increase students' effective use of information in general as well as their use of specific libraries and resources" (Eisenberg & Brown, 1992, p. 104).

The information research process is "a complex learning process involving thoughts, actions, and feelings that takes place over an extended period of time, that involves developing a topic from information in a variety of sources, and that culminates in a presentation of the individual's new perspective of the topic" (Kuhlthau, 1989a, p. 19). This process "is the user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem or topic," and "uncertainty and anxiety are an integral part of the process, particularly in the beginning stages" (Kuhlthau, 1991, p.361).

The goal of the media specialist should be to assure the acquisition of transferable skills such as accessing, evaluating, and using information. To accomplish this, the media specialist must intervene into the student's research process and help the student to understand and use that knowledge of the process. Understanding and learning the research process leads to a change in the thinking process and ultimately has an effect on the outcome of the search process (Kuhlthau, 1983).

Media specialists must assist students in the development of strategies that will enable the students to gain insight and to successfully structure approaches that will result in the ability to solve information needs. Students should be encouraged and taught to "think about their thinking," a process referred to as metacognition (Mancall, Aaron, & Walker, 1986). Similarly, Kuhlthau (1987) defines metacognition as the "reflecting on our own thinking processes and becoming aware of our own thinking patterns" (p. 25) and emphasizes that students must be made aware of the research process, must reflect on their process efforts, and must determine ways in which the process might be improved in the future.

Background to the Problem

There are a number of studies that have been conducted on the library information research process and the effects (both cognitive and affective) this process has on students engaging in the process. Kuhlthau has conducted a series of studies, both alone (1983, 1988a, 1988b, 1988c, 1988d, 1989b) and in conjunction with others (Kuhlthau, Turock, George, & Belvin, 1990; Kuhlthau, Turock, George, Varlejs, & Belvin, 1989) that deal with the cognitive and affective development of students participating in the research process. Kuhlthau's investigations have provided a window into the thoughts, feelings, and actions of the research process. If media specialists and other mediators understand students' information research experiences, then they will be more capable of designing interventions, assignments, and instruction that will help the students to increase their learning and to participate in a successful research experience.

Eisenberg and Brown (1992) point out that a number of process models for library and information skills have been developed. With the exception of Kuhlthau, however, these models (Cutlip, 1988; Eisenberg & Berkowitz, 1988; Eisenberg & Berkowitz, 1990; Irving, 1985; Stripling & Pitts, 1988) are not based on empirical research and have not been tested in field or laboratory studies.

Purpose of the Study

The purpose of this study (Friel, 1995) was to extend Kuhlthau's original findings concerning the research process and to validate the Kuhlthau model using low-achieving high school freshmen, rather than the advanced placement seniors that Kuhlthau (1983) used in her original research. A later study (Kuhlthau, 1988b, 1989b) involved high-, middle-, and low-achieving high school seniors, but the low-achieving students were difficult to track because of their frequent absenteeism. One of the study's focuses was on the extent to which these students were able to move through the predictable thoughts, feelings, and actions described in Kuhlthau's six-stage information search process model (1983). The second focus of the study and the focus of this paper was on the appropriate and timely interventions into the process by the media specialist that facilitated the students' movement through the process.

Focus of the Study

The media specialist, knowledgeable in the Kuhlthau model, was able to provide a variety of appropriate and timely interventions throughout the search, resulting in students moving toward information literacy. Of particular interest are the kinds of interventions made, their frequency, the point during the process when these interventions were made, and the conditions prompting the interventions. With the assistance of the media specialist and through the use of a variety of methods to observe and assess the research process, this study also focused on what interventions can assist students throughout the process and how these interventions can alter the research process and result in a successful introductory learning experience for students.

This study highlighted appropriate strategies and interventions into the information search process that take low-achieving students' needs into account. Levin (1987) argues that low-achieving or at-risk students have been neglected by the educational reform movement. He maintains that the majority of cognitive instruction has been reserved for high-achieving students, and low-achieving students have been left with basic skills instruction, thereby depriving those at-risk students of a vital learning experience. Here, cognitive instruction is defined as instruction that focuses on understanding and learning as that instruction's primary goals (Jones, 1986).

Presseisen (1988b) feels that "educators have neglected to encourage the connections of student thought processes with the more complex structures of thinking" (p. 49), and that students who miss out on higher-level thinking skills will never know what they do not know and will miss opportunities to transform their lives. This study shows that low-achieving students can learn and benefit from appropriate cognitive instruction.

This study provides information and data that can be used to provide learning experiences that will prepare students, regardless of their achievement levels, to access, evaluate, and use information. Studying the process of change and learning during the research process can facilitate the subsequent design of effective learning environments and experiences within schools.

Limitations of the Study

This study used a combination of qualitative and quantitative methods to permit students to reflect on the information search process and to measure and record the process as thoroughly as possible for study and examination. Primarily descriptive, the study used a number of methods and measurement tools that were developed and tested in prior studies of the research process and stressed the need for and the importance of interventions by mediators. Necessarily, there were certain limitations of the study that must be fully understood. The small sample size, homogeneity, and lack of randomization of the sample make it difficult to generalize the findings to the search process of a much larger population of students. Similarly, the short duration of the study (one six-week period) and the fact that the bulk of the information and media skills instruction were provided by one media specialist make it somewhat difficult to apply the findings to other settings, which, in all probability, will vary.

Review of the Literature

Information Science Research

Taylor's seminal study (1967, 1968) outlines four levels of information need and question formation that are reflected in reference questions: visceral (Q_1), the actual, but unexpressed need for information; conscious (Q_2), a conscious, but ill-defined area of indecision; formal (Q_3), an area of doubt expressed in rational and concrete terms; and compromised (Q_4), the need for information presented as a question recast in terms of what the information system can deliver.

Because sources are used in different ways and for different purposes at each level of need, library users must learn strategies that match their level of information need. Taylor found that library users often had difficulty consulting librarians for assistance, primarily because those users could not adequately express their information needs.

Taylor identifies two types of inquiry used to interface with the information system-- the command and the question. A command is a request for a specific item which the user assumes will satisfy an information need (p. 188). A question, however, is "ambiguous, imprecise, and requires feedback from a colleague, in order to provide an acceptable answer " (1968, p. 189). The command assumes 1) that the user knows exactly what he or she wants and can describe its form, author, and title, and 2) that the user knows and understands the functional organization of the information system. Taylor points out that while the first assumption may be valid, the second one usually is not. If students understand the various levels of need, they may be able to make requests that are more appropriate to a certain stage of the search process.

Taylor also speaks of the importance of the pre-search interview between the librarian and the information seeker. He believes that the librarian's task is to help the user develop the question through the four stages and ultimately arrive at an understanding of a compromised need through the determination of the subject of interest, the user's motivation, the user's personal characteristics, the relationship of the inquiry to file organization, and the anticipated answers. It is clear that the librarian can provide some type of intervention into the research process, and it is the reference interview, that is, the negotiation of questions, that results in the user's ability to problem solve, understand meaning, and adjust the question to meet the information organization of the library.

Other studies have explored the feelings of students about library research. Belkin (1980) and Belkin, Brooks, and Oddy (1982) describe how an information search moves from an anomalous state of knowledge (ASK) to a defined, coherent state. Initially, people realize that they need information to problem solve or reach a goal, but a lack of knowledge makes it nearly impossible to identify what information is missing.

Dervin (1977) speaks of the information search as a process of sense-making that occurs through communication between user and librarian and suggests that library activities and processes must be communication-, rather than information-, based. Dervin's contention is that the librarian's job is to help the user in this process, and the librarian must focus on useful intervention into the individual's sense-making process. That focusing will result in the librarian's helping people to inform themselves, create their own orders, and establish their own understandings. Because each individual's process and needs are unique, it follows that interventions must be appropriate and timely.

Dervin and Dewdney (1986) speak about the three key elements in this sense-making process model of information-seeking behavior and label them the situation, the gap, and the use. Information needs are situational, and during the reference interview, the librarian, acting as an intermediary between the inquirer and the system, must help the user to determine what he or she wants to know, a difficult task called query negotiation. With the librarian's assistance, the gap is gradually translated into question form, and the answer to the question permits the user to bridge the gap. The third element is use and that entails what the user wants to do once the gap is bridged. "Information does not have an independent existence but is rather a construct of the user" (p. 507).

Query negotiation, also called the reference interview, is used to determine what the user really wants to know. Dervin and Dewdney introduce the concept of neutral questioning, "a strategy for asking questions during interviews where the professional needs to find out what the user or client really wants" (p. 508). They classify questions as closed, open, and neutral. Neutral questions, a subset of open questions, are open in form, yet guide the interview conversation in order to elicit information from the user in regard to the type of situation underlying the question and information need, the gap faced, and the uses to which the information will be put once the question is answered or the information need met. This neutral questioning is user-oriented, rather than system-oriented, and recognizes that each user and his or her information needs are unique.

Mellon (1984, 1986, 1988) conducted a qualitative study that utilized students' personal writings over a two-year period and found that 75 to 85% of the students described their initial response to library research in terms of fear or anxiety. Terms such as scary, overpowering, lost, helpless, confused, and fear of the unknown appeared repeatedly in students' writings.

Mellon's findings indicate that these feelings stemmed from the large size of the library, inability to locate information, and failure to know how to begin and what to do. Many students mistakenly believed that other students were competent at library research and that they were the only ones who were incompetent. These students did not ask questions because they perceived that to do so would lead to a revelation of their incompetence.

The data indicated that this anxiety could be reduced by positive interaction with a librarian, and the librarians responded with a specially designed "warmth seminar." During this time, students got to know the librarians and realized that the librarians were eager to assist them with their research. Students were introduced to the librarians as potential mediators who were warm, friendly, approachable, and eager to assist students in the research process. The anxiety and its legitimacy were recognized, and successful experiences were offered in an effort to counteract the anxiety. The result was a reduction in library anxiety, after which the work of instruction could commence.

Swope and Katzer (1972) conducted a study to discover whether there were library users in existence who were reluctant to seek the assistance of the library staff and if they existed, how widespread the problem was. Using a questionnaire to structure interviews with university library users, the findings indicate that users were more inclined to ask directional questions (i.e. Where is the periodical room?) rather than reference questions. The study reveals that 75% of the interview respondents with questions would not ask a librarian for assistance. Primary reasons for failure to ask included dissatisfaction with the image or past services of a librarian, the belief that the question was too easy, or not wanting to bother the librarian. The need for user-centered library service is highlighted, as well as the need for librarians to hone the interpersonal skills and interventions that they use with library patrons.

Bandura and Schunk (1981) investigated students' beliefs about their abilities to perform certain behaviors that would result in designated outcomes. The result was that students who had positive attitudes about their abilities were more likely to actually learn. When dealing with difficult learning tasks, this finding was especially true. Students who believed in their abilities to perform well persisted longer than students who doubted their abilities.

Low Achiever Research

A review of the literature suggests that there is no single acceptable definition of the term low-achieving or at-risk (Lehr & Harris, 1988; Levine, 1988; Presseisen, 1988a; Slavin, 1989; Slavin & Madden, 1989; Swanson, 1991). Frequently the terms include students who have a variety of needs or special characteristics and whose academic achievement and skill levels are unsatisfactory. For the purposes of this study, a low-achieving or at-risk student was one who was not working up to potential (Lehr & Harris).

Generally, low achievers have academic problems, but many of them are able to learn when altered teaching methods are used. "These students are often disorganized and need assistance in planning and goal-setting; they may be inattentive and easily distractible with short attention spans" (Lehr & Harris, p. 11). Learning results when varied materials and strategies are implemented. Supportive learning environments can be used to build positive self-esteem, something that is lacking in many low-achieving students. This increased self-esteem enhances the probability of increased student achievement.

Lehr and Harris (1988) state that low-achieving students may be extremely dependent, often because they have not had enough successful learning experiences to permit them to rely on and trust their own abilities. Positive classroom management can help to eliminate discipline problems, and structuring the learning tasks in small sequential steps can help the students to succeed, thereby helping to motivate them to learn. Crawford (1989) and Brophy and Evertson (1976) stress that teacher attention to the organization of classroom activities, time-on-task, and maximizing the learning time of low-achieving students help contribute to increased student achievement. Helping students to organize information efficiently tends to result in student achievement gains (Larrivee, 1989).

Underachievers seem to learn best in an informal design, rather than in a formal classroom situation. Small group techniques or one-on-one with a teacher, rather than whole class instruction, help these students learn (Durán, 1988). Learning by listening is difficult for them, and learning through involvement is recommended (Carbo, Dunn, & Dunn, 1986). Learning activities where the students are physically and intellectually engaged and involved in hands-on learning are preferred (Lehr & Harris, 1988; Swanson, 1991). During this active learning, students have opportunities to make choices and learn self-direction. It is especially important that the teacher talk the students through the mental processes involved in problem solving (Levine, 1988).

Research shows that teachers who succeed with low-achieving students hold high expectations for students, believe that all students can learn and will succeed, and are persistent. All students are capable of learning and will be expected to do so (Crawford, 1989; Good & Brophy, 1986; Levine, 1988; Presseisen, 1988a; Presseisen, 1988b).

Classroom observations indicate that teachers spend more time interacting with low achievers than with relatively high-achieving students (Good & Brophy, 1986, 1987). "Improvement of at-risk students' performance with regard to thinking and other higher-order skills will require careful and continuous mediation by teachers and other adults" (Levine, p 118). In order to succeed, these students must receive personal guidance and strong intervention throughout the learning process, especially during the early stages. Brainin (1985) calls this mediated learning. The use of instructional strategies such as brainstorming and discussion, that are designed to share information, is also recommended (Jones, 1988).

Slower students often receive less attention, feedback, and reinforcement than faster-learning students (Swanson, 1991). This lack of feedback can undermine student motivation to learn (Smey-Richman, 1988). Teacher checks for learning progress, especially during independent work, should be frequent. Corrective feedback should be given whenever needed, and prompt reinforcement should be provided when students are successful. This reinforcement can result in increased student effort. Guidance, praise, attention, and support are vital to the learning of low-achieving students (Larrivee, 1989). Swanson concludes that "One of the most effective adjustments that we can make for at-risk students is to see that they receive larger amounts of immediate feedback" (p. 53).

Cognitive modeling is defined as "the information-processing and problem-solving strategies used when responding to academic tasks will be invisible to students unless teachers make them overt by showing students what to do and thinking out loud as they demonstrate" (Brophy, 1987, p. 48). An important instructional device, this modeling is also an excellent way to stimulate student motivation to learn, primarily because through modeling the students are exposed to "the beliefs and attitudes associated with such motivation (e.g., patience, confidence, persistence in seeking solutions through information processing and rational decision making, benefiting from the information problem-solving supplied by mistakes rather than giving up in frustration)" (Brophy, p. 48). Higher-order problem solving skills can be modeled by the teacher, the steps can be explained, and then the student can practice the steps as the teacher monitors the process (Jones, 1988).

Teachers can help students to plan approaches to a problem and strategies for problem solving and can monitor progress and facilitate the evaluation of their successes. Some possible instructional practices include using think aloud processes, writing thinking journals, participating in group problem solving and reflecting on progress and results, analyzing goal-setting progress weekly, and modeling by teachers and other students (Mirman, Swartz, & Barell, 1988, pp. 146-147). The goal is to help these students become independent learners who are more self-directed.

"When students learn how to learn--through metacognitive strategies--greater achievement can result" (Crawford, 1989, p. 288). Larrivee (1989) recommends empowering students through the teaching of specific learning strategies that result in more efficient student learning, while Presseisen (1988b) speaks of good teaching and high regard as the greatest potential bonuses for the at-risk students.

Librarian as Mediator

According to Kelly's personal construct theory (1955, 1963), behavior is determined by learners' personal constructs. In order to alter that behavior, the mediator must become involved in the learners' process of reconstruction, although the learners themselves must actually rebuild the constructs and assume some type of ownership. Although the thrust of Kelly's writing is not geared toward the role of mediator, he states that the role of the teacher is "to help to design and implement each child's own undertakings, as well as to assist in interpreting outcomes and in devising more cogent behavioral inquiries" (1963, p. 262).

The role of the librarian as mediator, someone who intervenes into the search process of another (Kuhlthau, 1983), was studied by Kuhlthau (1983), and interventions--possible ways to assist the student throughout the information search process--were explored. Because each student is an individual with unique information needs and personally-held constructs, Kuhlthau recommended an individualized approach to intervention (1983, p. 65). She saw the mediator's role as providing "a learning environment which enables the student to construe and reconstrue through positive experiences in seeking information" (p. 67).

In her original study, Kuhlthau (1983) made a number of observations concerning the mediator's role in the information search process. "The mediator's role is to introduce new sources, techniques and an awareness of the process itself to allow for construction to take place" (p. 70). Additionally, "the mediator can provide opportunities for students to have experiences in which they may develop constructs that enlarge the basis for the decisions they make" (p. 69).

The mediator can make sure that students make decisions during the information-gathering process that will help them to define and extend constructs. The mediator can also help the students to interpret the outcome of their decisions. The result is that students actively learn through the information search process experience (Kuhlthau, 1983, p. 72). If these decisions are made early in the search, there is a great likelihood that constructs can be construed and reconstrued.

At the beginning of Kuhlthau's study (1983), the students were administered a questionnaire to uncover their previous information search experiences and the constructs that they held in regard to libraries, research assignments, topic selection, focus formulation, search procedures, and the roles of librarians and teachers in the research process. At the end of the study, the questionnaire was administered again, and changes in the constructs that had been altered through the research experiences were highlighted.

Seven questions dealt with the role of mediators in the research process. Generally, the students viewed the role of formal mediators such as librarians and teachers as very limited. Most students experienced the research process without the assistance of formal mediators.

The interviews that Kuhlthau conducted with six students also revealed a limited role for formal mediators. Although students discussed their topic selection and its development with informal mediators, the students rarely consulted the librarian or the teacher. Similarly, a study of 385 library users in three types of libraries highlighted the perception that librarians had a very limited role in the search process (Kuhlthau et al., 1990). Librarians were not identified as consultants in 75% of the responses.

The student participants in Kuhlthau's study (1983) realized that they needed some type of process intervention and sought assistance from informal mediators such as parents, siblings, and friends. These case study participants indicated that they needed either the teacher or librarian in an expanded process-oriented role as a formal mediator. In fact, the students were sometimes confused as to what the teacher and librarian roles as formal mediators should be. The most important needs were for encouragement and the acknowledgment of the uncertainty of the process.

In other research, Reed (1974) studied the information seeking behavior of undergraduate students and found that many students had a poor or very limited understanding of the search process. None of the students sought assistance from the librarian, and this failure to seek assistance in selecting subject headings seriously limited the search strategies.

Possible Interventions

The study done by Kuhlthau et al. (1990) on the research process of academic, public, and school library users provided some implications for interventions into the research process. High school and college students exhibited an extremely low level of confidence at the beginning of the process, and there seemed to be a need for guidance and support in the early stages of the research process.

The study also revealed that the users frequently see the task of the research process as that of gathering information, even during the earlier stages of the model when users are trying to form a focus. Frequently the users are impatient and anxious to move along to notetaking, despite the fact that they have not yet formed a focus. In fact, nearly 50% of the participants failed to reach a focused topic at any point in their information search process. Intervention in the form of guidance and counseling from the media specialist and teacher could be especially helpful in getting the users to move through the critical stages of exploration and formulation. Kuhlthau (1993) elaborated on an uncertainty principle discussed by several other researchers (Shannon & Weaver, 1949; Whittemore & Yovits, 1973; Yovits & Foulk, 1985; Bates, 1986). In her earliest study (1983), Kuhlthau stressed the importance of tolerating ambiguity and uncertainty in the search process, especially during the early stages. Her newer work continues to stress that formulation of a focus is a vital, critical point in the search process. Here the user passes from uncertainty and ambiguity to understanding, and there is a resultant increase in the confidence level as the general topic becomes clearer. The mediator's role during this stage of the research process can be described as supportive, and the mediator should take steps to encourage exploration. During this exploration, information for formulating new constructs can be uncovered and reflected upon.

Kuhlthau (1993) indicates that there are several levels of intervention into the research process and that each level requires a different type of intervention into that process. The librarian must decide what the role of the librarian is in relation to the user and then select the appropriate intervention level. The five levels of intervention are outlined as: Level 1, the Organizer; Level 2, the Locator; Level 3, the Identifier; Level 4, the Advisor; and Level 5, the Counselor. Each level is identified with a type of intervention and also carries assumptions about the uncertainty principle.

At Level 1, no human intervention is required. Level 2 is used when the user has a simple, easily answered question. Level 3 occurs when the librarian sees the user once, and a group of resources that relate to the topic are identified.

The Advisor, Level 4, uses a pattern approach to intervention. The librarian helps to identify information sources and then recommends a particular sequence for using these sources, often from the general to the specific. Both librarian and user recognize that the research process takes place over a period of time, and several visits might be necessary. The emphasis is on the sources, the ability to access those sources, and the planned sequence for accessing those sources. One sequence of accessing is prescribed for all users, regardless of need or stage of the research process, and the individual learning process of the user is ignored completely.

At the highest level of mediation, Level 5, the Counselor, intervention into the process of the user is provided. At this level, the constructive process of the information research process is recognized. The problem of the user and the appropriate intervention are linked, and a dialogue is required between the user and the mediator. The uncertainty principle comes into play here, and the information seeking process is viewed as a learning, constructive process that seeks meaning. The sources and sequence of use cannot be prescribed in advance because these emerge as the topic and focus evolve. Other researchers investigating a similar information counselor concept include Debons (1975) and Dosa (1978).

Another form of intervention is instruction, and that can also be placed into levels that correspond to the Levels of Mediation: Level 1, the Organizer; Level 2, the Lecturer; Level 3, the Instructor; Level 4, the Tutor; and Level 5, the Counselor. Like the Levels of Mediation, the Levels of Education are determined by the complexity of the user's problem, but are differentiated by the number of sessions of instruction rather than the number of sources of information. In this way, education is categorized as being planned for one session, a variety of unconnected sessions, a sequence of related sessions, or holistic interaction over time. (Kuhlthau, 1993, p. 145)

Level 5, the Counselor, provides for holistic interaction over an extended period of time and an instructional emphasis on identification and interpretation of information that will address an evolving problem. Level 5 must be integrated into the curriculum, and instruction centers around the librarian's active involvement in designing, implementing, and evaluating instruction. The research process is viewed as one of problem solving and seeking meaning and includes accessing, interpreting, and using the information. Thoughts, feelings, and actions during the research process are recognized and understood, and the Counselor assists the user in the development of search strategies and the exploration of new ideas.

Opportunities must be provided for the user to understand the search process and reflect on and understand personal experiences throughout the process. Time and energy must be expended on interventions that are appropriate to the user's information need at a particular point in the information search process. Particular care must be taken to provide support and intervention during the early stages of the research process. "Education that guides students through stages of information need, to solve a problem or shape a topic, enables them to use information for learning. Information literate users are prepared to apply library and information skills through the course of life" (Kuhlthau, 1993, p. 154).

According to Kuhlthau (1993), a reflective professional will be able to determine when intervention is needed and what mediation and education is appropriate. Intervention into areas where the user is already self-sufficient is unnecessary. Rather, there is a zone of intervention where mediation is needed because the user cannot continue without the assistance of the mediator. Kuhlthau defines the zone of intervention as "the area where a user can do with assistance what he or she cannot do alone" (p. 155). Other researchers speak about zones of intervention (Durán, 1988; Tharp and Gallimore, 1988), and they emphasize that low-achieving students may be unable to work on certain learning tasks without the help of a teacher, mediator, or more capable other.

This idea of a zone of intervention is based on the studies of Vygotsky (1978) and his concept of the zone of proximal development. This concept states that there is a zone where intervention into the learning process of others would be most beneficial. He defines the zone of proximal development as "the distance between actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 131). This zone provides a mediator with an opportunity to intervene into the constructive process of another and indicates both intervention and information needs (Kuhlthau, 1993).

Kuhlthau (1993) makes the case that the zone of intervention for mediation and education into the information search process is analogous to the physicians' zone of treatment during which patient-physician interactions occur. These five zones of intervention correspond to the five levels of mediation and education. Professional mediators such as media specialists face the task of diagnosing timely and appropriate levels of intervention and education that will assist the user as he or she progresses through the information search process. Ultimately, the information professional must also draw on previous professional activity and on reflective activity that is like the reflection-in-action approach to problem solving that Schön (1982) advocates. "Reflection-in-action, guided by an internalization of the underlying patterns and principles in the process of information seeking, is a way to develop a new approach to services" (Kuhlthau, 1993, p. 177) that gives the user's needs priority over the needs of the information system.

Design of the Study

The second question that this study (Friel, 1995) investigated was appropriate and timely interventions by the media specialist that facilitated the students' movement through the information research process. The kinds and frequencies of interventions during the process and the points at which the interventions were made were studied. Additionally, the students developed an awareness of and became capable of using their own efforts to develop specific skills and strategies, worked independently, and controlled some of their own learning. Here the term awareness was defined as the knowledge of specific strategies, as well as the "knowledge of how to use them and when they should be used" (Jones, Palincsar, Ogle, & Carr, 1987, p. 15). Whether appropriate and timely interventions into the process helped to facilitate the process was determined by the students' abilities to understand the process and employ some of the attendant skills and strategies during the information search process.

The students were followed as they experienced the information search process using the process surveys at significant points in the process, daily student journal entries, written observations by the media specialist, an opportunity for students to share their personal research process experiences with the entire class, and open-ended interviews at the end of the information research process.

Each participating student was assigned a short English paper that required library research on a topic of student choice that was negotiated between student and teacher within stated boundaries. The students read an essay on bears and then participated in a brainstorming session that resulted in a list of diverse subjects that were possible topics for a library research paper. The research paper was defined as "a written presentation of information on a topic, commonly assigned as a course assignment. The information is focused on a narrow aspect of a general topic" (Kuhlthau, 1983, pp. 123-124). The required paper was a short expository one.

At the beginning of the project, the media specialist conducted a version of a "warmth seminar," based on Mellon's anxiety research (1984, 1986, 1988). The media specialist's "warmth seminar" included an introduction to the media center, its resources, and its staff members and emphasized frequent and positive interaction between media specialists and students. Students were introduced to media specialists as potential mediators who are warm, friendly, approachable, and eager to assist students in the research process.

The media specialist used this "warmth seminar" to introduce the students to the research process and its attendant sequence of feelings, thoughts, and actions, and a time line depicting this process was employed. Additionally, the purpose of the study, the expected benefits from participation, and the measurement tools and their use were fully explained. Kuhlthau (1988c, 1988d) recommended intervening in the process by promoting such an awareness, and this "warmth seminar" was the media specialist's interpretation of the recommendation.

The students were given six weeks in which to complete the research process. During that time, the media specialist taught predesigned instructional sessions based on the research process as outlined in Kuhlthau's *Teaching the Library Research Process: A Step-by-Step Approach for Secondary School Students* (1985), the same book that formed the basis of instructional sessions for an earlier study (Kuhlthau, 1989b). Topics included in the instructional sessions were those that provided the students with an understanding of the research process and appropriate strategies that helped the students to successfully experience each stage of that process. Care was taken to ensure that students were not pressured into premature decisions during the early stages of the process that might result in moving into the next stage of the model before they were completely ready. This caution was especially important during the focus formulation stage.

The research process was jointly taught to this class by the media specialist and an English teacher. The English teacher's primary task was teaching the students, where appropriate within the research process, several concepts and mechanics that were necessary. These included an introduction to what a thesis is and how to write one, selection of a topic for research, skimming, summarizing, notetaking, and proper bibliographic form.

In order to determine if the study procedures provided effective education, some type of criterion was necessary. In this instance, the measurement of the effectiveness of the procedures was based on Gardner's criterion--"an education that yields greater understanding in students" (1991, p. 145). Gardner makes the point that short-answer tests and oral responses in class can only provide clues to student understanding. More convincing evidence of understanding can be established through the use of open-ended clinical interviews and/or careful observations. In this study, the Reflective Questions Concerning the Information Research Process (see Appendix A) were used to conduct open-ended interviews at the end of the study, and the students concluded the research process unit with an open-ended discussion.

Good and Brophy (1986) encourage teachers to use a process that encourages students to reflect on and evaluate their own work, a skill that is necessary when students reach the status of independent, autonomous learners. Despite today's information and technology explosion, "people still must identify the problems and evaluate the information they gather. If anything, the need to evaluate one's work, assess one's inadequacies, and determine what is needed to correct the situation (i.e., to define problems) is greater than ever" (p. 503).

Gardner also recommends the use of a process-folio that documents student progress. He defines process-folio as "an effort to capture the steps and phases through which students pass in the course of developing a project, product, or work of art" (p. 240) and sees "the opportunity of keeping a process-folio and the potential of returning to it to reflect upon progress as well as on regressions and plateaus" (p. 241) as an important and invaluable learning experience. The intervention checklist (see Appendix B) was used by the media specialist throughout the study to keep track of the types and numbers of interventions offered by the media specialist, and the process surveys (see Appendix C) and student journals (see Appendix D) were used as the process-folios that helped to document student progress in the understanding of the information research process. The open-ended discussion and interviews were also included in the process-folios.

The media specialist administered a process survey at three points in the process, beginning (initiation), middle (midpoint), and end (closure). Process surveys were designed for and used in earlier studies (Kuhlthau, 1988b, 1989b; Kuhlthau et al., 1989; Kuhlthau et al., 1990), and the reliability and validity were established. The survey was an instrument that was used to collect data from the student sample, which was then analyzed and compared. The process survey (see Appendix C) used in this study was adapted from Kuhlthau's earlier studies.

Another instrument used in this study was the student journal. Students were first introduced to the concept of journal writing by their English teacher. They learned how to keep one and why the keeping of such a journal was helpful and informative to the journal keeper, as well as to the mediator. The students received additional direction in journal writing (see Appendix D) from the media specialist during the "warmth seminar." The students were required to record their feelings, thoughts, and actions related to the research process during every class period.

These journals were collected on a daily basis, read by the media specialist, and returned the next day. Daily collection not only provided the media specialist with some idea about how the search process was progressing and what the students understood and what confused them, but also provided the media specialist with intervention opportunities throughout the research process. After returning the journals, the media specialist clarified points of confusion for the students.

A Student Journal Instruction Sheet (see Appendix D) was used as a teaching tool by the media specialist during the "warmth seminar" and served as a journal writing model for the students. All of the questions that were included on that sheet were previously used by Kuhlthau (1985), with the exception of Questions 5 (What did I understand today?) and 6 (What did I find confusing?). Those two questions were added to the instruction sheet in order to help the media specialist monitor student understanding of the search process and to provide appropriate intervention opportunities when necessary.

Another instrument used during the study was a custom-designed intervention checklist (see Appendix B). The items included on this checklist are based on information-seeking behaviors and needs that have been described and documented in the literature. In an effort to determine what types of appropriate and timely interventions into the information research process were made by the media specialist, the checklist was filled in by the media specialist whenever one-on-one intervention was provided.

Although not field tested for reliability and validity, this form helped to facilitate the collection of quantitative data during the information research process and was used as an observation system, that is, " a system by which an observer records what is occurring in some situation or setting, such as a classroom" (Wiermsa, 1991). The observer recorded the presence and frequency of behaviors that were exhibited by students, and the checklist, a matrix-type observation system (Wiermsa), was used in a similar manner to that of a teacher's test. These forms were then analyzed and student-media specialist interactions, the kind and level of interventions, the frequency of these interventions, and the points during the process at which these interventions were made were determined. The intervention checklists permitted ongoing data collection during the research process, and the data was then triangulated.

Because the items included on the checklist are specific and operationally defined in the literature, only a medium degree of observer inference was required. This fact cut down on the ambiguity and uncertainty of the observations, as did a consistent interpretation of behaviors by a single observer. Finally, the section for additional notes and comments provided for flexibility on the observer's part (Kerlinger, 1986).

Discussion of Results

The first area addressed in this study was the extent to which low-achieving students were able to move through the information search process, and the second was appropriate and timely interventions into the process by the media specialist that helped to facilitate the students' successful movement through the process. The previously described tools used for the collection of data served the multiple roles of measurement tools and process interventions that Kuhlthau described (1993). Using data obtained through the use of multiple measurement tools permitted the researcher to triangulate the data, thereby providing the study with a greater degree of validity.

The organization of these findings essentially follows the development of the study itself. The question concerning the extent to which low-achieving students were able to move through the information search process was answered through analysis of student journals, process surveys, open-ended class discussion, and student interviews. The findings indicated that low-achieving students were able to move through the information search process according to Kuhlthau's six-stage model. Overall, the students' search processes were structured similarly to the processes of the high-and middle-achieving students who participated in earlier studies.

The study also indicated that appropriate and timely interventions into the information search process by the media specialist facilitated the students' successful movement through the process. These numerous interventions enabled the media specialist to assist students throughout the information search process, and without these interventions, those who worked with the students felt that the students would have been unable to successfully experience the process. The intervention question was answered through the use of a "warmth seminar" and the integration of several predesigned instructional sessions into the information search process unit, as well as through the analysis of student journals, question 5 of the process survey, observations recorded on an intervention checklist, class discussion, and student interviews.

Although the small sample size, homogeneity, and lack of randomization of the sample limits the generalization of the findings to a larger and more diverse student population, the descriptive and in-depth findings provide insight into the information search process and the interventions used with one class of low-achieving students. Thus, broader research can be conducted, based on the resultant data and inferences made from that data.

"Warmth" Seminar

Mellon's qualitative research (1984, 1986, 1988) explored students and their responses to library research and found that 75 to 85% of the students described their initial response to library research in terms of fear, phobia, or anxiety. The data indicated that this anxiety could be reduced by positive interaction with a librarian--a "warmth seminar"--and was used by librarians as a method to help alleviate this anxiety. The seminar helped students feel more comfortable in the library and permitted them to successfully conduct information gathering and research.

At the beginning of this study, the media specialist conducted a specially designed version of a "warmth seminar" that recognized library anxiety and its legitimacy. Efforts made to counteract the anxiety included an introduction to the media center, its resources, and its staff members. Emphasis was placed on the importance of frequent and positive interaction between media specialists and students, and students were introduced to media specialists as potential mediators who were approachable and eager to assist students in experiencing a successful information search process.

The media specialist structured this seminar in such a way that students were first introduced to the information search process and its attendant feelings, behaviors, and thoughts and then learned about the Kuhlthau six-stage model and the flexible time line that depicted this process. The students discussed the model and received copies it. There was emphasis on the fact that the feelings, behaviors, and thoughts that the students were going to experience during the information search process were both predictable and normal. Already familiar with journal writing, the students learned about the concept of the daily student journal that they were going to keep during the information search process, and discussed time for journal writing, what might go into the journal, and why students were being required to maintain a journal (see Student Journal Instruction Sheet in Appendix D).

The four-day "warmth seminar" provided the students with awareness and knowledge about the upcoming information search process experience and permitted the media specialist to intervene into the experience through the promotion of this awareness. The "warmth seminar" was both preparation for the information search process and an early stage intervention that helped to facilitate the students' successful movement through the process. The "warmth seminar" encouraged and nurtured a positive and supportive relationship between the media specialist and the students and emphasized the fact that having a successful information search process experience was of paramount importance. Presentation and discussion made it clear that the media specialist and the participating English teacher would be available to the students on a continuous basis, and all possible interventions would be taken to ensure that successful experience.

Those who worked with the students felt that the extended “warmth seminar” was vital to the students' successful experience with the information search process. The positive interaction with the media specialist helped to reduce the library anxiety. The media specialist involved in this study viewed the “warmth seminar” as a vital, early intervention into the first stage of the information search process and as important preparation for the remainder of the search process.

Teaching Approach

The approach to teaching the information search process to this class of low achievers was an active, participatory, constructive, learning process that incorporated ideas espoused by Dewey, Bruner, Piaget (1948), and Gardner (1991). The emphasis was on learning through the students' active involvement in making sense of the world and ultimately reflecting and developing some type of individualized understanding. As Bruner (1986) points out, it is not enough for students to gather information. Instead, the information must be interpreted, a task that is unique to each individual and is primarily based on previous experiences.

The literature indicates that many of the low achievers are able to learn when altered teaching methods are employed, and in this study, varied materials and strategies were used. The use of teaching methods that target low achievers served as an early and continuous intervention into the information search process and provided a way to assist the students throughout the process. Low achievers tend to be disorganized and need help with planning and goal setting and frequently have short attention spans (Lehr & Harris, 1988). Here Kuhlthau's six-stage model of the information search process provided the students with a framework, a time line, and predictions about their feelings, actions, and thoughts as they moved experienced the process. Students moved throughout the media center continuously and were encouraged to progress at their individual paces.

Low achievers often need a supportive learning environment that will help to build positive self-esteem, thereby enhancing the probability of increased student achievement. Lehr and Harris (1988) comment that low achievers may be extremely dependent because they have not had enough successful learning experiences to allow them to rely and trust their own abilities. The goal of providing a successful information search process experience for each student was clearly stated at the beginning of the process.

Interventions, especially conferencing, were provided by the media specialist wherever and whenever needed, and strong, positive classroom management resulted in few discipline problems to distract the students from their information search process experiences.

Teacher attention to organizing classroom activities, time-on-task, and maximizing the learning time of low achievers (Brophy & Evertson, 1976; Crawford, 1989) was incorporated into the information search process, as was Larrivee's strategy (1989) to help students organize information efficiently. The result of integrating these teaching approaches into the information search process was the tendency toward increased student achievement.

Low achievers seem to learn best in an informal design, and the media center was less formal and more flexible than the English classroom. The media specialist provided for as much one-on-one conferencing as possible, a teaching method that helps low achievers to learn (Durán, 1988), and also made sure that the students were physically and intellectually engaged and involved in hands-on learning (Carbo, Dunn, & Dunn, 1986; Lehr & Harris, 1988; Swanson, 1991). The frequent conferencing provided the media specialist with the opportunity to talk the students through the mental processes involved in problem solving (Levine, 1988).

The media specialist and the participating English teacher held high expectations for the students, believed that all students can learn and will succeed, and were persistent. These attitudes are highlighted by researchers (Crawford, 1989; Good & Brophy, 1986; Levine, 1988; Presseisen, 1988a, 1988b) and can help low achievers learn if incorporated into their learning experiences.

Another teaching methodology that will help low achievers to learn is frequent interaction (Brainin, 1985; Good & Brophy, 1986, 1987; Levine, 1988). Levine recommends careful and continuous mediation by teachers and other adults, and Brainin talks about mediated learning, a type of learning during which the low achievers receive personal guidance and strong intervention throughout the learning process, especially during the early stages. The use of instructional strategies such as brainstorming and discussion, that are designed to share information, is also recommended (Jones, 1988). The media specialist used all of these methods extensively with the students during the information search process.

Low achiever literature (Smey-Richman, 1988; Larrivee, 1989; Swanson, 1991) states that a lack of feedback during the learning process can undermine student motivation to learn and endorses frequent teacher checks for learning progress, especially during independent work. Large amounts of corrective feedback are vital whenever needed, and prompt reinforcement should be provided when students are successful. Cognitive modeling (Brophy, 1987), an instructional device during which teachers show students information processing and problem-solving and think out loud as they demonstrate, can help to stimulate student learning. Jones (1988) recommends that teachers model high-order problem solving skills, then explain the steps to students, and have the students practice the steps as the teacher monitors the process. All of these instructional practices were employed during this study.

Additionally, teachers can help students plan approaches and strategies for problem-solving, can monitor progress, and can facilitate the evaluation of student successes. During this study, students were encouraged to reflect on a daily basis in order to understand actions and results, a practice about which Dewey (1944) wrote, and this reflective component was an integral part of the learning process. Possible instructional practices include the using of think aloud processes, writing thinking journals, participating in group problem solving, reflecting on progress and results, and modeling by teachers and other students (Mirman, Swartz, & Barell, 1988). Presseisen (1988b) believes that good teaching and high regard will result in learning bonuses for low achievers. Again, these practices were incorporated into teaching the information search process.

Many educational approaches and practices that are beneficial to the learning process of low achievers were incorporated into this study's information search process. A supportive, hands-on learning environment, frequent intervention from the early stages of the process, and one-on-one conferencing that provided feedback, analysis, modeling, opportunity for reflection, and praise were particularly important. Additionally, an informal instructional design, persistence, patience, and high expectations for a successful learning process resulted in student learning and achievement.

Predesigned Instructional Sessions

During the six weeks that the students experienced the information search process, the media specialist taught several planned instructional sessions to the entire class. These teaching sessions were based on the information search process that Kuhlthau outlined in *Teaching the Library Research Process: A Step-by-Step Program for Secondary School Students* (1985) and were interventions because they were ways to assist the students with the information search process. This book was the same one that formed the basis of the instructional sessions for an earlier study (Kuhlthau, 1989b), and some similar instructional sessions had also been used in Kuhlthau's original study (1983). The main objective of all of the sessions was to support the students throughout the entire search process. Topics included in those instructional sessions were those that helped students understand the research process and provided the students with appropriate strategies that allowed them to successfully experience the information search process.

One session was devoted to brainstorming possible topics that students might select for their research project. Students were encouraged to let their minds flow from one potential topic to another, and there was discussion concerning the mental connections between seemingly unrelated topics. A second session was needed to complete the lists. Most of the students selected their topics from the brainstorming lists, although students were free to select a topic that did not appear on the lists. These brainstorming sessions provided the students with opportunities to share, discuss, and clarify their ideas for topics.

After the brainstorming sessions, the media specialist spent time outlining criteria for choosing a topic. Students were encouraged to consider several questions when selecting a topic: Is the topic of personal interest? Does the topic meet the English teacher's requirements for the project? Can information be located and organized within the time allotted for the project? Can adequate information be located in the media center or in available materials? (Kuhlthau, 1985). During this session, the students discussed, interpreted and clarified each question.

The next session that the media specialist taught involved the use of clustering and mind maps, both methods to graphically represent thoughts and ideas and to show their connections to one another. After learning about these techniques, the students had the opportunity to do their own clustering/mind map activities with a topic of their own choosing. All of the topics were potential research topics. When the students were finished, they shared their exercises with each other in small groups.

During another session, the students learned about the use of general encyclopedias and dictionaries to obtain overviews of possible research topics. Once the students selected possible topics, they were instructed how to use general encyclopedias and dictionaries in order to learn what is known about these particular topics. The media specialist explained that before a student could focus on a topic, the student needed to obtain some overall knowledge about that topic. The students were urged to use encyclopedias and dictionaries to obtain an overview of all topics that were being considered, thus assuring an informed choice of topic.

The last instructional session taught by the media specialist was provided late in the research process and at the point when many students were trying to make decisions about bringing their searches to closure.

Class discussion was included, and many students reflected on their own situations in regard to closing their own searches.

Additionally, the participating English teacher taught several predesigned instructional sessions during the process. Her primary objectives were teaching concepts and mechanics that the students were going to need and use during their searches. Topics for the class sessions included how to select a topic that addressed a specific idea, purpose, and audience, what a thesis statement is and how to write it, as well as skimming, summarizing, notetaking, and proper bibliographic form. These predesigned units were conducted during parts of several class periods, were taught at the appropriate points in the information search process, and dovetailed with the sessions that the media specialist taught.

All of these predesigned instructional sessions functioned as interventions into the information search process of the students, with emphasis on the creative and constructive processes used, rather than on the mechanical aspects of searching. These sessions provided student support, were ways to assist the students throughout the search process, and enhanced the students' chances of success.

Student Journals as Interventions

In this study, the student journals served two purposes. First, the journals were used as data gathering and measurement tools, and data was amassed and later sorted, categorized, and analyzed. The journals were also used as process interventions into the information search process.

Because the media specialist read the journals on a nightly basis, she was able to discern where each one of the students was in the search process at any given time and was also able to determine whether students were confused or were having problems, as well as at what point in the search process these confusions or problems were developing. Usually the media specialist was able to meet with those students during class time the next day and discuss the confusions or problems and begin interventions that would result in clarification and problem solving.

The media specialist, now a mediator who was able to intervene into the students' search processes, could intervene early or late in the search process and as frequently or as infrequently as necessary in order to support the students and help them to successfully experience the information search process. In the instances where the students were self-sufficient, there was no need to intervene at all. When the students indicated problems, however, the media specialist matched the student zone of intervention to the level of mediation required. The zone of intervention is that area where intervention into the learning process of others is beneficial (Vygotsky, 1978). That is the "area where a user can do things with assistance that he or she cannot do alone" (Kuhlthau, 1993, p. 155).

Once alerted to the students' information needs through the reading of the journals, the media specialist used professional judgment to determine what student questions needed answers and what problems needed solving. The next step required the media specialist to be reflective and to decide how much intervention and education was required by each student (Kuhlthau, 1993). The media specialist then established a dialogue with the student and translated these needs into action, always mindful that interventions should be carried out and then stopped once the problem is solved and the student becomes self-sufficient.

The interventions that were provided by the media specialist took many forms, depending on the individual needs of the students at any number of points in the process and addressed both product and process problems. Interventions included, but were not limited to, clarifying to eliminate confusion through both group meetings and individual discussions, instructing locating and using print and nonprint reference sources, assisting with planning search strategies, discussing possible topics, assisting with the narrowing of a topic to formulate a focus and assisting with selecting a particular focus while discarding others. Additional interventions provided by the participating English teacher included clarification and conferencing.

The majority of media specialist intervention that resulted from reading the student journals took the form of conferencing. These meetings with students provided immediate and ongoing opportunities for student-media specialist communication. Some of the conferencing activities included clarification, instruction, education, discussion, planning, guided thinking, the introduction and use of critical and higher level thinking skills, and pep talks.

Conferencing provided the students with support throughout the information search process and demonstrated that the media specialist was involved with the process and willing to intervene where necessary to ensure that the students had successful experiences. The media specialist was able to intervene into the constructive processes of the students at the most beneficial times and provide strong personal guidance and intervention, especially at the early stages, a technique that is called mediated learning and is recommended for use with low-achieving students (Brainin, 1985).

Intervention Checklist

The custom-designed intervention checklist was used to collect data during this study. Large group and written interventions were relatively easy to keep track of and to record, but the one-on-one interventions posed record keeping problems. This checklist recorded the type of interaction, types of reference question formulation, inquiry and query negotiation used, the kind and level of intervention given, and any comments or anecdotal notes that the media specialist chose to record.

Table 1 depicts the number and type of student-media specialist interventions that occurred during the information search process. Frequency indicates the number of times that a type of intervention was provided by the media specialist, and percentage of interventions indicates what percentage of the total number of interventions that frequency represents.

Table 1

Frequency of Interventions as Recorded on Intervention Checklist

Intervention	**Frequency**	**% of Interventions**
Conference	72	63.7
Instruction	32	28.3
Reference	9	8.0
Total Responses	113	100.0

N=113

Conferencing

There was a total of 113 one-on-one student-media specialist interactions recorded during the information search process. Of those interactions, 72 or 63.7% of them were conferences. The conferences occurred on a continuous basis throughout the search process, with an almost equal number taking place during the first and second halves of the process (34 for the first half and 37 for the second half). These conferences varied in length, and in some instances lasted for five minutes, while in others much longer.

Every student had at least three conferences with the media specialist, while some students conferenced with the media specialist on a more frequent basis. At all times, the need for conferencing was indicated by the information needs and problems of the students, and the conferences were held as soon as those needs and problems became apparent to the students. Although conferencing was encouraged by the media specialist and the participating English teacher, it was not required of the students and was conducted at student initiation. It is important to note that the participating English teacher also conferenced with students on a regular basis, both during and outside of the English class period. Although these student-teacher conference interventions were not formally counted, the conferencing provided additional interventions that assisted students through the information search process.

Generally, the conferences included discussion about myriad aspects of the search process, frequently including, but not necessarily limited to the following: possible strategies to find information and work through the six stages of the information search process; what the students planned to do next in their searches; possible topics and focuses; feedback from the media specialist; verbalization of thoughts and ideas that often resulted in some type of clarification of these thoughts and ideas; how to get a general overview of a topic before formulating a focus; how to deal with topics that resulted in too little or too much information; how to skim sources for ideas without getting bogged down in copious notetaking and documentation; how to formulate a focus into a thesis statement; making sure that there is enough information to support the thesis statement; making decisions about when to bring the information search process to closure. Any aspect of the information search process was open for discussion during the conferences, and each conference was unique and tailored to students' individual needs.

Instruction

During 32 or 28.3% of the one-on-one student-media specialist interactions, the students received instruction from the media specialist. Frequently, the need for instruction became apparent during a conference session, and it was not unusual for a conference to result in a one-on-one instructional session with a student. All of the instruction occurred during the first two-thirds of the time devoted to the information search process, and no one-on-one instruction was provided by the media specialist during the last third of the process.

There was a variety of instruction provided by the media specialist, and as was the case with the conferences, the instruction was student-initiated and was based on students' information needs and problems. Some areas that were covered in instructional sessions included: using the new computer online catalog in the media center; using the online computer terminal that connected to the union catalog of a public library consortium; using the CD-ROM workstation; using Infotrac; using the index in a general encyclopedia; locating books in the circulating stacks through the use of the Dewey Decimal System; using the table of contents and index to locate needed information in a book; using the microfiche readers; making microfiche copies of magazine articles.

The media specialist noted that a number of students were familiar with the media center and needed minimal instruction from the media specialist during the study. In several instances, a student was knowledgeable in the use of a piece of equipment and taught its use to another student. Possibly this familiarity reduced the number of instructional sessions that the media specialist was required to offer.

Reference Assistance

The media specialist provided the students with reference assistance on nine occasions (8% of the one-on-one interventions). In all instances, this assistance was provided near the end of the information search process, at a time when the students had focused topics and knew enough about the information system that they were able to recast their reference and information needs into what the system offered. Usually, the request for reference assistance was made outside of a conference situation.

Summary

The high number of student-media specialist conferences and other interactions indicated that the students in this study were willing to confer with media specialists and use them as mediators during the information search process. This finding was different from those in other studies (Kuhlthau, 1983; Kuhlthau, 1988c; Kuhlthau, 1988d; Kuhlthau et al., 1989; Kuhlthau et al., 1990; Reed, 1974) where the students did not view the media specialist as a mediator whose job was to intervene into the information search process. In those studies, the media specialist's role was perceived as minimal and almost exclusively locational in nature, while in this study the perceived role was that of an active and involved mediator. As previously mentioned, one probable reason for the students' willingness to conference was the four-day "warmth seminar" that nurtured and encouraged positive student-media specialist interactions throughout the information search process.

Levels of Information Need

The second part of the intervention checklist dealt with the students' levels of information need and question formations that were reflected in the reference questions that were asked. The media specialist recorded the number of instances where reference questions reflected Taylor's four levels of information need (1967, 1968). The reason for recording was to see whether the reference questions changed as the students moved through the information search process. The expectation was that students' abilities to express their information needs would move through the levels as the information search process continued. As students focused on their topics, their thinking would become more narrow and specific, until students would be able to express their information needs in compromised questions that were recast in terms of what the information system was capable of providing and delivering.

When the students began the information search process, they found it difficult, if not impossible, to express their information needs. Their level of need, Q_1 or visceral, was vague, but unexpressed. This level of information need was experienced by all of the students when they first received their research assignment and arrived in the media center with feelings of dread and doubt.

After beginning the information search process, the students began to interact with the media specialist, and during these interactions, the students formulated and expressed reference questions that reflected their changing information needs. On 34 occasions, students asked reference questions at the Q_2 or conscious level. Q_3 or formal level questions were asked 29 times, and Q_4 or compromised level questions were asked 19 times. Frequently, the students discussed their level of information need with the media specialist during conferences. The questions that the students asked were considered reference questions and were not the reference interventions that were described earlier.

Taylor's research (1967, 1968) found that library users often failed to consult with the librarian at the Q_2 or conscious level, primarily because these users were unable to sufficiently express their information needs. The students in this study, however, did not have difficulty consulting the media specialist at this level and possibly these consultations helped to resolve the ambiguity that the student was feeling.

According to Taylor (1967, 1968), the librarian's task is to help the user develop the reference question through the four stages and finally arrive at an understanding of a compromised need. In this study, one type of intervention into the users' information search processes was accomplished through reference interviews that took place between student and media specialist. These interviews involved negotiation of the reference question, and the students attempted to describe for the media specialist not something that was known, but something that was not known. As the students moved through the information search process and met with the media specialist on a continuing basis, their thinking became more focused and specific, until they were able to express their information needs in terms that the information system can deliver. This finding was similar to what Taylor's levels of information need (1967, 1968) predicted.

Inquiry: Command and Question

The students used the two types of inquiry while interfacing with the media specialist: the command and the question. During the information search process, students used command inquiry, a request for a specific item that will satisfy an information need, a total of 23 times, while also using question inquiry, an imprecise inquiry that necessitates feedback from someone else before an answer is possible, a total of 55 times. Generally, and as predicted by the literature (Taylor, 1967, 1968), questions tended to be at levels Q_3 and Q_2, while commands were usually at level Q_4 and were compromises that matched the information system.

On occasion, students presented requests as commands, especially at levels Q_2 and Q_3. At these times, the media specialist intervened verbally into the students' thought processes in order to find out exactly what their information needs were and to ensure that their requests matched the way or ways that the information was ordered in the media center. Without that intervention, many of the students would have been unhappy or frustrated with searches that failed to produce the necessary information to satisfy the students' information needs. The media specialist paid careful attention to the types of inquiries made by the students and used every appropriate opportunity to intervene and assist the students throughout the information search process.

Query Negotiation

Not all important insights into interventions were revealed by counting frequencies of interventions. The type of query negotiation (commonly called the reference interview) that took place between the student and the media specialist served as appropriate and timely interventions. The interview provides the librarian with an opportunity to intervene into the research process and serve as an intermediary between inquirer and the system (Dervin & Dewdney, 1986). This intervention is used to discover what the user's information needs are--what the user really wants to know. Ascertaining this need can help the user make sense of the research process and allows the librarian to continue interpreting and guiding the user successfully through the research process. The media specialist took care to focus on neutral questioning, a type of open questioning that recognizes that each user and his or her information needs are unique. This awareness of and focusing on neutral questioning resulted in the media specialist's careful monitoring of her reference interviews with the students. By emphasizing this type of questioning, the media specialist was able to provide intervention into the students' search processes and assist them in making sense of the accessed information.

Level of Media Specialist Intervention

The media specialist also recorded the levels of intervention (Kuhlthau, 1993) that were used as the students experienced the information search process. The bulk of one-on-one interventions offered by the media specialist during this study was at level 5, the Counselor. In addition to Kuhlthau, Debons (1975) and Dosa (1978) have also examined the information counselor concept. At this level of intervention, the information search process is recognized as a constructive process that links the problem of the user with appropriate intervention, and an ongoing dialogue is required between the user and the mediator (media specialist). During this study, the media specialist repeatedly used conference time to establish and continue dialogue, encourage and assist students in selection of topics and then formulation of focuses, explore strategies and sequences appropriate to individualized search processes, determine most useful sources, assist in interpreting and applying information, make sure that students satisfied their information needs, and reflect on and evaluate the information search process.

Summary

The frequencies and types of one-on-one interventions that the media specialist used with students were an integral part of the information search process and helped the students to successfully experience this individualized, sense-making, constructive process. Because the information search process is unique for each student, it follows that the media specialist cannot provide a prescriptive map that will enable all students to successfully work through the process. Instead, the media specialist had to provide the students with as much time, direction, guidance, and support as they needed.

Class Discussion

The open-ended classroom discussion conducted at the end of the information search process permitted the students to reflect on and share the experiences that they had during the process. This reflective piece is an integral part of the learning process (Gardner, 1991; Good & Brophy, 1987; Kuhlthau, 1994) and provided the students with a way to evaluate the effectiveness of the research process and to think about ways in which the process could be improved.

The class discussion allowed the free exchange of students' points of view, and the students mentioned several appropriate and timely interventions that facilitated their successful movement through the information search process. The discussion also provided supporting information that enhanced and bolstered previously found data that was obtained through the use of other methods of data collection and measurement. The class discussion reinforced was the "warmth seminar" and its importance in helping students to overcome their fear and negative feelings about the information search process and toward libraries in general. The students were relieved once they knew what to expect during the process and also felt reassured after learning that their feelings, behaviors, and thoughts were predictable and normal.

Interventions during difficult times--when students found too little or too much information or when writing thesis statements--were important. Students also mentioned that familiarity with equipment and search techniques and strategies made the information process easier. Finally, the daily journals and frequent conferencing were seen as important and integral components of a successful information search process.

Student Interviews

The student interviews were conducted after the students completed their research assignments and wrote their short papers. The interviews helped to reveal a deeper understanding of the research process and also allowed triangulation of the interview data with data obtained through the use of other measurement tools. These interviews offered an additional opportunity for reflection and for raising self-awareness.

Question 9, the last question asked during the student interviews (see Appendix A), was designed to pinpoint interventions that helped the students to successfully navigate the information search process or potential interventions that could help the students to successfully experience the process in the future. Students had many ideas about what media specialists could do in order to facilitate student passage through the information search process. Several students indicated a continuous need for conferencing and assistance with learning about research techniques and strategies. One mentioned that the media specialist was "really a help" and would always assist him, and the conferencing with the media specialist "made it [the information search process] pretty easy" and enabled him to narrow his topic. Another stated that he needed nearly-constant conferencing with the media specialist, "just to make sure [I'm] on the right track."

This reference to the importance of student-media specialist conferencing was a recurring theme throughout the student interviews. Analysis of the student interviews indicated that student-media specialist conferencing was among the most important and worthwhile interventions that could be offered throughout the information search process. The consensus of the students was that the conferencing helped students to learn research techniques and strategies and also helped students to understand the process, focus their topics, and sort through all manner of confusion, questions, and information overload.

Overall, the students felt that they survived the process, had learned from it, and were willing to tackle a research assignment again. The students felt both confident and successful. Using Gardner's criterion for measuring the effectiveness of the experience--"an education that yields greater understanding in students" (1991, p. 145)--the information search process unit could be deemed effective and successful.

Summary of Findings

This study's findings validated many appropriate and timely interventions that the media specialist and the participating English teacher provided during the information search process, and the descriptive and in-depth findings provided insight into the types and timings of various interventions. Indications were that these interventions needed to be offered continuously throughout the six stages of the process, especially during the early stages. The provision of a positive, hands-on learning environment that sets high expectations and provides strong support, encouragement, and careful and continuous mediation by the media specialist is vital if the low achievers are to have successful learning experiences. This personal guidance, including corrective feedback and prompt reinforcement when students are successful, along with discussion and modeling, can contribute to a successful information search process and a learning experience that results in student learning and achievement.

Conclusions

Several conclusions can be drawn from this study of low achievers as they moved through the information search process. Although the small sample size, homogeneity, and lack of randomization of the sample in this study make it difficult to generalize the findings to the information search process of a much larger population of students, the results of this study confirm Kuhlthau's original findings concerning the information search process and extended those findings to one group of low-achieving high school freshmen. The low-achievers involved in this study did have thoughts, feelings, and actions that were similar to higher-achieving students who moved through the information search process and the 6-stage Kuhlthau model.

A second conclusion that can be drawn from this study is that the media specialist, knowledgeable in the Kuhlthau model, literature concerning information science research, and literature concerning the provision of learning environments for low achievers, was able to provide a variety of appropriate and timely interventions into the information search process. These interventions, when used throughout the process, and especially during the early stages, assisted students as they experienced the information search process and resulted in an altered process, as well as a successful introductory learning experience for the students. The frequent interventions provided throughout the information search process and a strong commitment from both media specialist and participating English teacher were vital to student success, and without those two components, the students would have been unable to successfully experience the process.

Appropriate interventions were provided at points in the process when they would be most beneficial and would contribute most to student learning and success. The media specialist did not expend time and energy with interventions into areas and at times during the process when the students were self-sufficient. Instead, the media specialist focused on a zone or zones of intervention (Kuhlthau, 1993; Vygotsky, 1978), "an area where a person can do with assistance what he or she cannot do alone" (Kuhlthau, 1993, p. 155). This area was defined by Vgotsky as the zone of proximal development, where adult guidance or collaboration with more capable peers would provide a means for bridging the gap between actual development level and potential development level. In this study, the media specialist and participating English teacher made those interventions and were instrumental in moving the students to those higher developmental levels.

Implications for Practice

The findings generated by this study provide empirical evidence to validate and inform a number of beliefs concerning the teaching of library and information skills. The research suggests ways in which media specialists and teachers can provide learning experiences that will help to prepare students, regardless of their achievement levels, to access, evaluate, and use information to answer a question or to solve a problem. Studying and understanding the process of change and learning during the information search process can facilitate the design of effective learning environments and experiences within schools and can offer all students the opportunity to learn how to learn.

Reflection on the information search process and what occurred is an integral part of the students' learning process. Research suggests that allowing time for reflection and thinking, whether in written journals, conferences, discussions, interviews, and/or thoughts, is important to the learning process and provides students with opportunities to look at what was understood during the process, what was confusing, and how and where thinking and actions could be altered or improved next time. Similarly, this study shows the value of the reflective piece, and encourages the use of that piece in any information process approach. Without reflection, the learning process will be incomplete, and successful learning will not result.

Students need sufficient and unhurried time to work through the information search process. The four-period "warmth seminar" used at the beginning of the information search process set the tone for a successful information search process and learning experience. The preparation for a successful learning experience cannot be hurried, and those four classroom periods were necessary to provide the students with background and awareness that would ensure student success.

Students need ample time to experience the actual information search process. Traditionally, students were expected to do the major part of a research assignment independently, often with little opportunity for teacher or media specialist guidance. In many instances, students were expected to select a topic, focus, and write a thesis statement within a class period or a day. The students might come to the media center for several days, researching and receiving brief, mostly source-oriented instruction from the media specialist, but then the students were frequently asked to complete the research assignment independently, which usually meant with minimal teacher or media specialist assistance and support. An approach like this often resulted in confused, frustrated, and upset students, who completed a product, a research paper, but failed to learn very much along the way. The next research assignment would be as dreaded, difficult and confusing as the ones before it.

The information search process is a process, rather than an event, and cannot be hurried if the students are to have a successful learning experience. Although the students generally conformed to the six stages of the Kuhlthau model, no two information process experiences were alike. Instead, each student's pace was unique, with some students reaching the focus formulation stage early in the process and others reaching that stage only several days before the end of the assignment. Similarly, each student's cognitive experiences progressed at different rates as the students moved through the stages of the model.

A supportive, nurturing learning environment during the information search process is necessary. Although the information search process unit was designed using teaching approaches and strategies that had been shown to maximize learning and student achievement with low-achieving students, similar approaches could benefit students at all levels of academic performance. Studies have shown that middle- and high-achieving students experience the thoughts, actions, and feelings predicted by the Kuhlthau model, and methods that will enhance student achievement and learning should be encouraged.

The finding that conferencing by the media specialist was the single most important intervention can be applied by media specialists and teachers alike. This conferencing provided opportunities for ongoing student-media specialist communication. It allowed the media specialist to intervene into the information search process of the student and determine exactly what the student's information needs were at any given point in the process. It then required the media specialist to reflect on that information and make an informed professional decision in regard to the interventions most appropriate and useful to the individual student.

In the role of mediator, the media specialist can focus on zones of intervention where the media specialist can help students do with assistance what they cannot do alone. Defined as the zone of proximal development by Vygotsky (1987), this is the zone where a media specialist's guidance can provide a way to bridge a student's actual development level with that student's potential development level. A commitment and willingness to assist that student can result in moving the student to a higher level of achievement, and without that guidance and support, the student would be unlikely to succeed at each stage of the information search process.

Naturally, it is impossible for the media specialist to provide appropriate one-on-one interventions for every student at every point in the information search process. Interventions provided to the class as a whole therefore were important to the success of the students' processes and learning experiences. All of the students benefited from interventions. After the students have numerous successful experiences with the information search process, we assume they will become more independent learners, and the need for interventions will decline. Media specialists will not need to intervene into areas where the students are self-sufficient.

The results of the study clearly show that students will use media specialists and teachers as mediators frequently and throughout the information search process if a positive relationship is cultivated early in the process and efforts are made to neutralize the library anxiety that the students feel. In this instance, the extended "warmth seminar" was used as the vehicle to develop the media specialist-student relationship and to help alleviate the library anxiety that the students felt at the beginning of the process.

Awareness and understanding of the importance of query negotiation (the reference interview) and of the types of inquiry and questioning techniques that might be used during the interview will permit the media specialist to obtain a more accurate picture of the user's information needs at particular points in the information search process, thus allowing the media specialist to consider and use the most appropriate and timely interventions possible. Similarly, awareness of the four types of reference question formation and the levels of information need that they represent may be another way to assist the media specialist in making interventions that will help students to fulfill their information needs and to also successfully experience the information search process.

The results of this study provide media specialists with evidence that students can learn and use a process approach that requires them to be actively involved learners for an extended period of time and expects them to develop and use their cognitive and higher level thinking skills to problem solve. The findings of this study add to evidence that the process approach succeeds. They will provide media specialists with additional evidence to justify the design and implementation of media skills and programs that are process-based. This study indicates that the information search process and appropriate and timely interventions work when used with a small group of students.

The results of this study serve to increase media specialist and teacher awareness of students' experiences as they move through the information search process, which can result in the design of effective learning environments and media experiences within media centers and schools. This awareness can also facilitate the design of research assignments and interventions that will require students to access information, read and evaluate it, and then put that information to use to answer a question or to solve a problem.

The findings of this study encourage and support team teaching between media specialists and subject area teachers. This information search process study, a collaborative effort by the media specialist and an English teacher, was integrated into the freshman English curriculum. Responsibilities for the unit were planned and shared jointly, and both media specialist and English teacher instructed and supported the students as they moved through the information search process. While team teaching, the need for two-way communication between media specialist and subject area teacher was constant. The process approach "offers them [media specialists] a tool for teaming with teachers which, combined with expertise in resources, makes them extremely valuable partners" (Kuhlthau, 1989a).

Through awareness and knowledge of the process approach and its impact on students, the media specialists are empowered to become key players in the educational restructuring process. They are in excellent positions to take leadership roles in the educational restructuring process that will result in change, an emphasis on student learning and achievement, and the ability of schools to prepare students to become lifelong learners.

These findings have the potential to impact on the education of media specialists, teachers, curriculum developers, and administrators. It is vital that all groups of educators be introduced to the process approach to developing thinking skills in students. This awareness and knowledge should be included in educators' preservice education programs. Special emphasis should be placed on the importance of the integration of the process approach into all subject areas, and the positive student learning experiences that can result from cooperation between media specialists and other educators.

Implications for Further Research

One possibility for further research is a comparative analysis of an intervention and a nonintervention group. Kuhlthau's original study (1983) contained a limited comparative analysis of two such groups, but further study could expand these findings. Such a study would help to broaden the understanding of the information search process and of the effects of the specific interventions that are used throughout the process. A more quantitatively structured study would permit the researcher to determine what role each of the interventions played in the success of the information search process.

The findings of this study indicate that appropriate and timely interventions into the information search process are important with low-achieving students. Studies focusing on all types and levels of interventions with low-achieving, as well as with middle- and high-achieving students, will help to clarify the role that interventions play during the information search process. Special attention should be directed toward interventions that are used early in the process, and especially those used during the most pivotal stages of the process--topic exploration and focus formulation.

Because communication between media specialist and student is vital to the success of the information search process, further investigation should be made into query negotiation, questioning techniques, and how various types of inquiry might be used to best advantage by the media specialist during the information search process. The investigation might also include reference question formation and the levels of information need that they represent. Further knowledge about these communication components and how they are related to the information search process can result in identifying how they can be used to identify a student's information need and to then make appropriate and timely interventions into the information search process.

Now that library and information skills are moving toward a process approach, it makes sense to determine how (or whether) this process approach is reflected in the scope-and-sequence of library media programs. It would be informative to know whether this approach is being integrated into library media programs and whether media specialists are teaching such a process or merely giving it lip service. If the approach is being integrated and taught, then how successful is that integration and teaching?

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Appendix A

REFLECTIVE QUESTIONS CONCERNING THE INFORMATION RESEARCH PROCESS

1. Describe how you felt when the teacher announced the research assignment.

2. Describe how and why you chose your topic.

3. Describe how you focused on your topic.

4. Describe how you used the library at the beginning, at the middle, and at the end of your research assignment (before actually writing your paper).

5. Describe any choices that you made during your search that helped you to find just the information that you were looking for, changed your mind about your topic, led you to a new understanding of your topic, or helped you to decide upon the direction of your study.

6. How did you know when your search was completed?

7. Describe the conclusion of your search and how you feel about your work.

8. What did you find most difficult about your search? Why?

9. How did librarians assist you (instruction, reference)? How could librarians be more helpful?

Adapted from Kuhlthau's "Developing a Model of the Library Search Process: Cognitive and Affective Aspects" (1988)

Appendix B

Date ________________________________

Student Name ________________________________

INTERVENTION CHECKLIST

1. During his or her visit to the media center, the student interfaced with the media specialist in the following way(s):
____ Received reference assistance from the media specialist
____ Received instruction from the media specialist
____ Conferenced with the media specialist
____ Other
Description of activities:

2. Using Taylor's levels of information need, the student's interaction with the media specialist resulted in the following type of reference question formation:

____ Q_1 Visceral (vague, but unexpressed)
____ Q_2 Conscious (conscious, but ill-defined)
____ Q_3 Formal (rational and concrete)
____ Q_4 Compromised (recast in terms that the information system can deliver) Question(s):

3. The student used the following type(s) of inquiry while interfacing with the media specialist:
____ Command
____ Question
Inquiry:

4. The query negotiation (commonly called the reference interview) included the following type(s) of questions:
____ Open
____ Closed
____ Neutral
Question(s):

5. The level of media specialist intervention included:
____ Level 1, the Organizer
____ Level 2, the Locator
____ Level 3, the Identifier
____ Level 4, the Advisor
____ Level 5, the Counselor

6. Additional Notes and Comments:

Appendix C

PROCESS SURVEY

Please take your time, think carefully, and then answer the following questions:

1. Name the source you are using.

2. What are you looking for?

3. State the title of your project.

4. Describe the topic in a short paragraph.

5. Who have you talked to about your project?

6. Rate your confidence level at this point in the project, using a scale of 1 to 10, with 1 being the lowest confidence level and 10 the highest.

|_____|_____|_____|_____|_____|_____|_____|_____|_____|

1 2 3 4 5 6 7 8 9 10

LOW HIGH

7. From the adjectives listed below, check those that describe how you feel at this point in the project. Check as many adjectives as apply to you.

__ Confident	__ Confused
__ Disappointed	__ Doubtful
__ Frustrated	__ Optimistic
__ Relieved	__ Satisfied
__ Sure	__ Uncertain
__ Bored	__ Tired
__ Other ________________________	

Adapted from Kuhlthau's "Information search process: A summary of research implications for school library media programs" (1989) and "The information search process of high-, middle-, and low-achieving high school seniors (1989)

Appendix D

STUDENT JOURNAL INSTRUCTION SHEET

You have already learned how to write a journal in your English class and have practiced writing entries. The daily journal that you will write for this unit will record the progress of your media center research. You will have about 10 minutes during class each day when you will be expected to write in your research journal. Please use the notebook that you have received from your English teacher, bring it to class each day, and date each entry. Your entries may include:

1. What are my thoughts about my research?

2. What action(s) have I taken?
   What sources have I used?
   With whom have I talked or consulted?
   What other strategies have I used? (An example is making a list.)

3. What feelings am I experiencing?

4. What do I plan to do next?

5. What did I understand today?

6. What did I find confusing?

7. Include any other comments, thoughts, or ideas that you might have as you move through the information research process.

The journals will be collected periodically and returned the following day. Your journal will be considered part of the research assignment to be turned in with the completed research paper at the end of the project.

Adapted from Kuhlthau's *Teaching the Library Research Process: A Step-by-Step Program for Secondary School Students* (1985)

Author Biographical Notes

Linda de Lyon Friel

I received a Bachelor of Arts from Northeastern University and a Master of Science in Library Science from Simmons College. I received an Ed.D. in Leadership in Schooling from the University of Massachusetts-Lowell, where my research focused on using Kuhlthau's six-stage information research process model with low-achieving freshmen and on the interventions that facilitated the process. I have been a public librarian and a school library media specialist in elementary and high schools and am currently the Supervisor of Media Services for the Methuen Public Schools in Methuen, Massachusetts.

One recent project was a book entitled *A Travel Agent in Cyber School: The Internet and the Library Media Program* (Libraries Unlimited), jointly with John F. LeBaron and Catherine Collier. Other projects include co-chairing a technology committee that wrote a five-year technology plan for the school district, helping to integrate the use of technology into the curriculum, integrating the information research process into all subject areas, planning, developing, and building the media center collection for a new K-8 school, and providing children with student-centered media centers that will help to expand their learning opportunities. I also served on the committee that rewrote the state standards for Massachusetts school library media centers.

Treasure Mountain 6 provided an opportunity to dialogue with colleagues about the importance of the information search process. It reaffirmed my contention that students must be solidly grounded in accessing, evaluating, synthesizing, and using information. If students are to graduate from school and be lifelong learners in our information-rich society, it is vital that they be taught the information search process. Information is central to all subjects, and students must be able to "wade through" that information, analyze and synthesize it, and then end that process through the construction their own meanings. Library media specialists must continue to be proactive in integrating such a process into school curricula.

Location vs. Reflection: School Librarians, Student Thinking and the World Wide Web

Mark W. Gordon

Abstract

This paper addresses both a philosophical and practical level new roles for Library Media Specialists, especially in schools where staff members are rethinking curriculum and other aspects of their program. It explores the importance of developing and applying critical and reflective thinking to the virtual electronic libraries we are encountering daily. It sets out approaches and techniques, based on actual practice, for dealing with the massive lists of references engendered by World Wide Web search engines. Finally, it argues that librarians must be important players in their schools' curricular reform efforts if they are to be sustainable.

Introduction

It is important to consider how powerful thinking skills--habits of mind--can be applied in the World Wide Web (WWW) environment. The techniques necessary to intelligently use search tools and other Internet features are eminently teachable. The cultural shift necessary to get students (and often adults) to slow down and take the time to analyze Web-based information requires a serious, coordinated school wide and perhaps community wide effort. The school librarian is the obvious person to be sounding the alert: advocating for and leading this consideration.

The coincidence of two powerful and interrelated forces are affecting the role and the perceived relevance of school librarians. The extraordinary development of the Internet, and particularly the World Wide Web, poses complicated and fascinating challenges. The development of school reform efforts to redesign curriculum and other school structures offers unprecedented opportunities for librarians. This paper discusses school librarians' unique relationships to three particular issues whose resolution, I believe, determines a school's effectiveness at redesign.

1. The need for techniques for applying critical and reflective thinking to the process of obtaining and using Internet based information sources.

2. The inherent contradiction between the rapidity and vast quantity of information presented on the net, and the slow pace required by reflective thinking about what is presented.

3. The need for classroom teachers to embed information literacy methods in their curricula, which also means that each classroom teacher must master those methods.

Issue #1. Critical and reflective thinking

Throughout this paper I refer to "habits of mind". What are they? "Habits of mind" is a shorthand way of referring to thinking that is critical, analytical and reflective as opposed to mere recall of stored facts. At New York City's Central Park East Secondary School and other schools, the habits of mind are elaborated as a series of questions that concern evidence, point of view, connections, supposition and relevance.

Here are the questions: [1]

1. How do you know what you know? What's the evidence? Is it credible?
2. What viewpoint are you hearing, seeing, reading? Who is the author? Where is she/he standing? What are his/her intentions?
3. How are things connected to each other? How does "it" fit in? Where have you heard or seen this before?
4. What if...? Supposing that...? Can you imagine alternatives?
5. What difference does it make? Who cares?

The development and application of these habits of mind to any piece of work or set of ideas, from whatever source, is a high stakes goal for schools seeking to provide students with the capacity to use their minds well. It is painstaking work. It goes against the grain. It requires reflection and rejects the quick and easy answer or response. Instead it encourages challenges to any response: students will be called upon to defend their statements with evidence. (Appendix 1 contains suggestions for applying habits of mind to the net.)

The World Wide Web or some enhancement of it appears, if present trends continue, likely to become the most powerful mechanism for the delivery of information and data. Projects like the Library of Congress' American Memory, in which 5 million primary source documents in American history and culture are being digitized and made available to all via the WWW are receiving substantial corporate, foundation and government support. This impulse to digitize not only to preserve rare or unique items, but to disseminate them more widely than anyone could have imagined just a decade ago, is likely to continue and deepen.

To become a valuable resource for students in schools, however, WWW features, strengths, weaknesses and curiosities, must be keenly understood by it's users. Tools, techniques and practice which take advantage of the strengths of these features and mitigate against adverse effects need to be routinely understood and utilized in schools. Some of these features are:

- non linearity
- decentralization
- lack of mediation of content
- rapidly expanding content base
- capacity to convey multi-media
- ease of switching to other features of the Internet, like e-mail or news.

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[1] This list, in substantially the same language, is posted in the classrooms at Central Park East Secondary School, where I served as Librarian for 10 years. It is not intended as a definitive list. Some teachers and schools add items concerning the effect of personal bias on ideas, or a consideration of how an idea may be understood by members of particular groups.

School librarians have both a clear overview of the school's curriculum and a deep understanding of the structure of information. Because of this unique combination, they can exert important influence on the success of school reform efforts.

Issue 2: Location vs. Reflection.

We are inclined lately to disparage the slowdown of the WWW that has resulted from the explosive growth in the number of its users. But it would be foolish to either dismiss the Web as hopelessly bogged down, or to fail to take serious note of its astonishing speed. Compare a query using the Alta Vista search engine (http://altavista.digital.com) to the use of print indexes which were normal fare in school libraries until recently. (Of course, the Internet is not a carefully thought out database. However the digital speed of all on-line electronic tools pose similar problems.) It is likely that speed will be accelerated thereby allowing searches of ever larger databases of full text items as well as vast quantities of multi-media information. Most WWW searches nowadays result in a gigantic list of responses, some relevant, many not; some valuable, many insignificant. In a minute more references arrive than one could have been gotten in a week using older methods.

It's worthwhile thinking about how that research week might have gone a decade or two ago. While compiling the list of references from many indexes, the mind wanders, plays on the items discovered. You might mention one or two unusually interesting ones to friends or families over meals or during a break. The information found is percolating and infiltrating throughout the recesses of your mind, and connections and evaluations are being made. This, without ever looking at the items referenced. Prioritizing, evaluating and preparing to digest the content is unconsciously going on. At the point when reading or examination begins, you have already formed an initial lattice upon which to hang ideas. In this case, it's plain to see, the "medium" and the mind's need to reflect are in harmony: there's enough time built in.

How different in the digital world. Nearly instantaneous results leave virtually no time for internal processing. The list and the medium demand an immediate choice. There is no time built in unless it is deliberately placed there by users. Taking this time is contrary to all the trends resulting from the introduction of technology. Because the machines can do things faster, the expectation is that we will work faster. Schools especially must reconsider this implication in all its applications of technology, and especially in cases where technology is used to access information.

Issue 3: Librarians, teachers and curriculum.

In many schools where teachers are encountering information technology, there is an impulse to establish a department and create labs where tech teachers and/or librarians will deal with the machines and the knowledge students need in order to use them effectively. Many teachers are very leery of attempting to teach students the effective use of information technology. Some who have experienced success over many years without using electronic information tools are reluctant, sometimes intimidated, and even hostile to the notion that they should utilize and master the new skills needed. While this may be understandable, I believe a case can be made that it is a disservice to our current students who are growing up in an age dominated by computer-based information storage and dissemination. Not being able to negotiate this world will leave students crippled. Failure of a teacher to take into account the technological reality students experience may lead to disrespect for the educational process in that teacher's class. School librarians can be most helpful in addressing this issue. They can do this in three ways: by mastering the new Internet information tools and techniques, by advocating for curricular change at whose core are information literacy methods, and by supporting colleagues as they become adept Internet users.

How can we restore good "habits of mind" and appropriate information technology use to their rightful place? Here are some observations I offer for discussion.

It cannot be done by school librarians alone. This is a concern that must be addressed by the whole school community, including parents, teachers and students. A strategy to accomplish this is needed in every school.

Reflective time must be built into every class that is using information technology. (And every class ought to be using it). This means that research processes, far from being sped up by technology, will have to be slowed down. It may appear that less is "produced," but depth and thoughtfulness take time.

School librarians have to play a far more proactive role in developing curriculum. They ought to be moving away from a reactive mode (Teacher says "I'm 'doing' China next week"; librarian scurries about and gathers up books and other resources on China) and place ourselves in the consultant mode as often and as completely as possible. It is not merely knowing what resources they have, although this is very important. It is ensuring two things: first, that teachers understand the techniques students need to master in order to apply the habits of mind to electronic information resources; and, second, that enough time is built into the class' plan of work to allow for critical and reflective thinking. This requires close collaboration with classroom teachers. It is likely that school librarians will need to help their colleagues develop competence in the information skills their students are expected to use.

The school librarian's role shifts as the information technology shifts. In this period of redefining roles, the librarian should not shirk from the opportunity of becoming the school's master of the WWW and other information technologies and their curricular implications. They should be high profile participants in schoolwide curriculum restructuring discussions and decisions. We should be asking questions like: How can we insure that all students in our school understand how to apply good habits of mind and why they are important? How can one apply the habits of mind while using search engines? How do we make sure that whenever teachers assign research to students that they understand what the experience of their students will be, so they can adequately coach them?

The spectacular growth of the Internet, and particularly the World Wide Web as an information resource, has profound implications for schools. School reform efforts which aim at more intense interdisciplinary inquiry and research by students require a rich information environment to be sustained. These two powerful trends in education point directly at an enhanced role for the school librarian. School librarians already have a deep understanding of information structures. They embody long established practice of interdisciplinary coaching techniques promoting critical and reflective thinking. They are pivotal to sustainable school reform and successful information technology use.

Appendix 1 and 2 contain two handouts I have used in workshop sessions on Habits of Mind and the Internet. They are intended to be used while participants are sitting in front of an on-line terminal. I offer them as examples of how school librarians can help the adults and students of their schools to apply critical and reflective thinking to the Internet environment.

Appendix 1

Using WWW Search Engines to apply Habits of Mind

Choose a topic to search. Use a Search Engine like Alta Vista (http://altavista. digital.com) to narrow the results to less than 1000 hits. (Use the on-line "Help" facility Altavista offers) Examine the resulting list of items, make some selections to examine, and proceed through the questions.

Question #1: Why did you choose a particular item to select for examination?

Question #2: What is the organization or source of the item?

(Find the home page. Can you identify a mission or agenda for this site? Is this the original source of this item or is it copied from someplace else. If copied, can you find out from where? Can you go to that site?)

Question #3: Who's quoted in this article? What else do they think?

(Do a search on a quoted person's name using a WWW Search Engine. Can you find any connections or patterns? Does this information offer insight to the original item?)

Question #4: What do links from this site tell you?

(Go to some linked sites and note their purpose and the kind of information they offer.)

Question #5: Can you use a Search Engine to verify things presented as facts?

(How?)

Question #6: What other ways could Search Engines help in the application of Habits of Mind?

Appendix 2

Criteria for choosing which “hits” to examine

1. **Search Engines try to weight items** according to criteria they establish. It is helpful to know the criteria for the Search Engine you are using. Check the “Help” utilities at the Search Engine site.

2. Three bits of information on the bottom line of each item listed may be helpful.

A. The URL

1. The **suffixes** can be helpful. .gov indicates a government source; .edu is a source from an educational institution; .com is a commercial site and may have something to sell rather than information to offer. Reminder: The site on which this item appears may not be its original site.

2. Newer addresses use geographical rather than broad domain suffixes like .edu or .com. The final element in these URLs is the country suffix: .us for United States, .ca for Canada, etc. In this type of URL, **internal elements** can give you clues. Example: What can you guess about the source of this URL? http://ed.co. sanmateo.ca.us

3. Similarly, it is sometimes possible to divine source information from internal elements of traditional URLs. (A university name? A well known corporation? A news source?) Example: http://home.aisr.brown.edu It’s worth trying to guess, and rule out those items that seem less likely to be worthwhile.

B. The size.
This can be tricky because a very small document may consist of a key link to other sites or documents. However, a large size generally indicates a substantial document that may, (a) take a long time to load (b) have a lot of text (c) have a lot of graphics.

C. The date
This may help. If you want information about something and you know the date of a key event, eliminating items with dates before that event eliminates many items. The date refers to when the item appeared on that web site, not necessarily when it originated. The US Constitution is a case in point.

2. **The Title** of an item attracts your attention, but may be very misleading or unhelpful. Good information may be hidden in an item called “No Title”.

3. **The first two lines of text** in an item sometimes gives you a flavor of what the site contains. It’s a clue, but not always very clear.

Author Biographical Notes

Mark Gordon began his library career as a children's librarian at New York Public Library and made the transition to public schools as librarian of the Ralph Bunche School in New York. In 1984, he was invited by Debbie Meier to help create Central Park East Secondary School. In 1992, Mark moved to California and has been working in the Bay Area Coalition of Essential Schools and the Bay Area School Reform Collaborative. Most recently, he has been developing the Bay Area National Digital Library Project in conjunction with the Library of Congress.

Motivational Aspects of Library and Information Skills Instruction: The Role of the Library Media Specialist

Ruth V. Small

Abstract

Effective library and information skills instructional programs not only help students acquire the skills they will need to solve their information problems, but also stimulate intellectual curiosity and encourage continued information seeking and exploration. This paper describes some theories and concepts of motivation and their relationship to library and information skills instruction. Illustrations of the integration and application of motivation models to library and information skills instruction and some relevant areas for future research on motivation in this context are suggested.

Introduction

Library media specialists teach curriculum-integrated library and information skills to students at all grade levels. Other than Kuhlthau's work on the affective aspects of information seeking behavior, research on and development of models of library and information skills instruction have largely focused on cognitive processes and content, with little attention paid to motivational issues. Yet, one widely accepted goal of education is to develop intrinsically motivated, life-long learners who want to learn, who enjoy the learning experience while it is occurring, and who continue learning after the instruction has formally ended.

Standards for library media programs and services (e.g. *Information Power*, 1988) mandate that the role of the library-media specialist is to help students become effective users of ideas and information. To achieve this mission, effective library and information skills instructional programs must not only help students acquire the skills they will need to solve their information problems, but they must also stimulate intellectual curiosity and encourage continued information seeking and exploration. This requires research that identifies ways for library-media specialists to incorporate effective motivational interventions into their instruction. This paper will present (1) some of the theories and concepts of motivation and their relationship to library and information skills instruction, (2) a systematic model for designing motivating instruction, (3) ways to integrate and apply motivation theories and models to library and information skills instruction, and (4) some relevant areas of future research on motivation in this context.

Theories and Concepts of Motivation

Much of past research on motivation (mostly from the 1930s to the 1970s) has taken place in the field of industrial psychology, focusing on ways to motivate people in the workplace; i.e. how to get workers to work harder, faster, and better. Within the past twenty years with the increasing importance of identifying effective motivational techniques for improving classroom management and accommodating the ever-increasing diversity of student populations (Wlodkowski, 1981), there has been a shift in that research from the workplace to the classroom. As a result, a number of researchers have begun to focus on ways to apply some of the same theories and concepts found to be effective in industry to the teaching-learning environment. The following section of this paper briefly describes some of these theories and concepts and provides relevant examples of motivation strategies for library and information skills instruction.

Need Theory

There are several theories that focus on human needs, but perhaps the most recognizable is Abraham Maslow's Hierarchy of Needs (e.g. 1943). Maslow identified five categories of needs that are both universal across various populations and hierarchical in nature, i.e. each preceding level of need must be satisfied before the higher level need can be met. The five categories of needs, from lowest to highest, are:

- physiological needs (basic needs such as food and water)
- safety needs (safe and secure physical and emotional environment)
- belongingness needs (acceptance and friendship)
- esteem needs (a positive self-image and attention and appreciation for one's contributions)
- self-actualization needs (developing one's potential to the fullest degree)

(Steers and Porter, 1987).

This theory is as relevant today as it was when Maslow first proposed it. It provides the rationale for the breakfast and lunch programs, security systems, and self-esteem-building programs in many of our nation's schools today. Students cannot learn and develop intellectually when they are hungry, afraid, or self-loathing. Library-media programs can contribute by helping students understand and develop effective information literacy skills that facilitate their success in the classroom.

Achievement Motivation

Based on the work of preceding need theorists, especially Henry Murray (1938), David McClelland (e.g. 1961) developed the theory of achievement motivation which identifies three important needs that are universal, present to a greater or lesser extent in all people, but not hierarchical. These needs are:

- need for achievement (the need to strive for personal excellence),
- need for affiliation (the need for social interaction), and
- need for power (the need to exert influence over others).

Students with a high need for achievement prefer moderately challenging learning tasks (e.g. using an online search strategy to locate relevant research materials). Students high in "need for affiliation" prefer activities that allow them opportunities to interact with other students (e.g. cooperative learning teams are formed to complete an oral history project). Students with high need for power prefer activities in which they can assume leadership roles and have an impact on others (e.g. students are asked to debate the topic "Restricting Student Use of the Internet").

High Need	Task Preference	Example Task
Achievement	Challenging	Independent research project
Affiliation	Interactive	Team project
Power	Influential	Peer tutoring

Library-media specialists with an understanding of achievement motivation might incorporate a range of activities into their instruction that motivates students with these varying needs.

Attribution Theory

Attribution theory (e.g. Weiner, 1972; 1979), proposes that people will ascribe one of four (two internal, two external) attributions to their success or failure at a task. These attributions are: (1) ability (they succeeded because they are smart or talented or failed because they are not); (2) effort (they succeeded because they worked hard or failed because they did not put forth enough effort); (3) task difficulty (they succeeded because the task was at the appropriate level of challenge or failed because the task was too difficult---or even succeeded because the task was too easy); and (4) luck (they succeeded or failed because some external force made it happen---e.g. the teacher did or did not like them; there was a full moon; they were sitting in the "lucky" or "unlucky" chair).

Students who experience repeated failure, who do not perceive their actions as influencing these negative outcomes and who attribute failure to external forces may develop a condition known as "learned helplessness" (Seligman, 1975). Learned helpless people just give up---they don't make any effort, even when there is clearly an opportunity for success. Instruction that, where appropriate,[1] encourages students to take more internal responsibility for their own learning success or failure, will help to motivate them to continue learning. An example of an effective motivational strategy related to attribution theory is: Praise students' understanding and application of the information problem-solving process and attribute it to paying attention, listening, and using critical thinking skills.

Intrinsic-Extrinsic Orientation

The literature distinguishes between two general types of motivational orientations (e.g. Rotter, 1966; deCharms, 1968; Deci, 1975). For students exhibiting an intrinsic orientation, participation in the learning task provides its own motivation; it is the desired end. Students exert effort because the task itself (1) stimulates curiosity and interest through uncertainty or challenge or (2) promotes satisfaction through feelings of competence or control (e.g. Brophy, 1988; Butler, 1988; Gottfried, 1985; Lepper, 1988). Students with an extrinsic orientation, on the other hand, perform a task as a means to achieve a desired end, typically some external reinforcement, such as a tangible reward or praise. Marshall (1987) found that when teachers used intrinsic motivators (e.g. gave reasons for the importance of the learning task or encouraged students to relate the task to their personal needs or experiences), there was a higher rate of on-task behavior and higher motivation toward the task. In contrast, Newby (1991), in a study on the use of motivational strategies by teachers in elementary classrooms, found negative correlations between the number of extrinsic motivators (i.e. rewards, punishments) used and the amount of task engagement.

Although previous research provides some evidence that intrinsic rather than extrinsic strategies are the most effective for long-term learning motivation, there have been no studies, to date, that examine the use of either of these motivators in the context of library and information skills instruction. Such research may provide information about any unique features of that context (for example, the integration of information literacy skills with the curriculum), as well as the types and amount of motivational strategies that are most effective for stimulating curiosity and information-seeking behaviors.

Expectancy-Value Theory

A theory related to both achievement motivation and attribution theory is expectancy-value theory (Vroom, 1964; Porter and Lawler, 1968). It identifies *effort* as the major measurable motivational outcome. It specifies two necessary preconditions to effort--- (1) valuing the task and (2) expecting to succeed at the task. Applying this theory to library and information skills instructional situations, the task (or content) should be presented in a way that (1) is engaging and meaningful to the student (e.g. tying the instruction to a class assignment) and (2) promotes positive expectations for successful achievement of learning objectives (e.g. showing samples of successful assignments completed by other students at that level).

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[1] There are times when it is inappropriate for students to have an internal attribution (e.g. "I can't learn this because I'm just not smart enough") and appropriate to have an external attribution (e.g. The test really was too difficult for the level of the learners).

Curiosity

Berlyne (1960) describes curiosity as a state of arousal brought about by complex stimuli and uncertainty in the environment which leads to exploratory behavior. He identified two types of exploratory behavior: diversive (a reaction to boredom) and specific (a reaction to some conceptual conflict posed by the environment). The latter type he described as "epistemic," curiosity that can only be resolved through the acquisition of knowledge. Berlyne asserted that stimulus uncertainty (exemplified by unfamiliarity, novelty, complexity, ambiguity, or incongruity) increases the arousal level and curiosity. When presented with a stimulus that has a moderate degree of uncertainty, the individual engages in exploratory behavior (e.g. information seeking, information processing, evaluating information) in order to resolve the conceptual conflict and return to a moderate, pleasurable level of stimulation (referred to as "the tonus level") in which the individual functions most effectively (Arnone and Small, 1995).

Extending Berlyne's work, Day (1982) describes the optimal level of arousal as the "Zone of Curiosity," characterized by excitement, interest, and exploration to resolve the conceptual conflict. This optimal level of arousal varies from individual to individual. Too much uncertainty can send an individual into the "Zone of Anxiety," resulting in feeling overwhelmed and anxious, while too little stimulation can send an individual into the "Zone of Relaxation," resulting in disinterest and boredom. An individual in either of these zones is likely to withdraw from any exploratory behaviors before resolving the conceptual conflict. An example of a strategy to arouse and sustain curiosity might be: Introduce information problem-solving as a "mystery" to be solved and have the students be "detectives" and then provide a series of "clues" that lead them through the process as they search for the solution to their information problem.

Flow Theory

Building on the research of Berlyne and others on curiosity, Csiksentmihalyi (1975, 1990) identified "flow" theory which predicts that an experience will be most positive when a person perceives that the environment contains enough challenge, matched with the person's skills (Csikszentihmahlyi & LeFevre, 1989). A flow state is one in which a person (1) suspends time and space while fully immersed in a challenging activity, (2) focuses attention on a limited stimulus field which provides clear and unambiguous feedback on his/her actions, (3) experiences a sense of control, and (4) finds the experience, itself, rewarding (Csikszentmihalyi, 1975; 1990). Csiksentmihalyi found that flow experiences can occur in any context (e.g. ballet, road construction, chess) with any age level but have three requirements: appropriate level of challenge, clearly defined goals, and immediate and useful feedback on progress.

Most of us have experienced flow---that pleasurable feeling of being so engrossed in an activity that we lose all sense of time and space. Clearly stating the objectives of the instruction and criteria to be used to evaluate their completed research projects might be one step in facilitating a flow experience for students as they become involved in the research process.

Research on Motivation

Research on motivation in classroom settings indicates that students perceive their own motivations inextricably linked to the motivational quality of the instruction they receive. Small and Gluck (1994) found that adult subjects believe both the instructor and the learner are important motivating factors. In a study of college students' perceptions of interesting and boring instruction, Small, Dodge and Jiang (1996) found that most students hold the instructor accountable for making the instruction either interesting or boring. Therefore, it would be useful to identify ways to make instruction as motivating as possible for students.

The limited research on motivation in the field of library and information science has largely focused on student behaviors and outcomes in relation to the information search. For example, Kuhlthau's (e.g.

1993) work has explored the thoughts, behaviors, and feelings that students experience as they go through various stages of the research process. She describes the "exploration stage" of research as the most difficult, where students encounter information that is "inconsistent and incompatible and does not match what they already know" (p. 13), resulting in feelings of anxiety, uncertainty, and a lack of confidence. This is consistent with Day's Zone of Anxiety, where an activity has too much uncertainty, resulting in students feeling overwhelmed and anxious.

It is about midway through the process, during the focus formulation stage, that this uncertainty is resolved and confidence restored (Kuhlthau, 1993). It is at this point that the student returns to the moderate, pleasurable tonus level.

In a study on information search styles and gender, Burdick (1996) found that more than one-half of the students in her study, regardless of gender, ranged from mildly to highly detached, disinterested or bored with the information search process (characteristic of Day's Zone of Relaxation, when the person has received too little stimulation). Burdick emphasizes the importance of instruction that develops both ability (i.e. knowledge and skills) *and* desire (i.e. motivation). Research is needed to identify instructional strategies that help achieve that optimal level of arousal (Zone of Curiosity) characterized by excitement, interest, and exploration during the information search process.

Instructional Motivation Models

Several researchers have recommended a range of instructional strategies for motivating students. Dodge (1989) developed a method for analyzing an unsuccessful lesson and provided ideas for improving it. For example, if the instruction contains too many facts or new words, he recommends providing a glossary of new words and concepts as they are needed and using mnemonics to help students remember facts. For instruction that arouses too high a level of uncertainty, he suggests creating a structured problem situation that requires students to form and test hypotheses.

Based on a synthesis of research on instructional motivation, Brophy (1987) identified some general requisites for motivating instruction. These include providing a supportive environment and meaningful learning objectives, maintaining student expectations for success, supplying extrinsic incentives, and capitalizing on students' existing intrinsic motivation.

In a library and information skills instructional context, Kuhlthau (1993) recommends the use of curriculum-related questions or topics, an introduction by an engaging speaker, brainstorming to clarify and share ideas, and pointing out the applicability of one situation to a range of other situations as effective strategies during research process instruction. Burdick (1996) suggests helping students better understand the information-seeking task, encouraging a range of search styles, and allowing for different levels of success as ways to increase students' feelings of competence and confidence.

The researchers noted above provide support for the importance of instructional motivation and offer some examples of useful approaches or strategies. However, none of these authors provides a *comprehensive and systematic framework* for designing instruction that enhances student motivation. The following section describes such a model.

The ARCS Model of Motivational Design

Using expectancy-value theory as a foundation where effort is believed to be one of the strongest influences on learning and performance, Keller (e.g. 1979, 1983) synthesized the motivational concepts and theories described above and others into a comprehensive model of instructional motivation---the ARCS Model of Motivational Design---an easy-to-apply, heuristic approach to increasing the motivational appeal of instruction. The ARCS Model, a simple yet powerful motivation model, appears to hold great promise for applications to library and information skills instruction.

The ARCS Model identifies four essential components of motivating instruction:

- [A]ttention - the instructor uses strategies for arousing and sustaining curiosity and interest;
- [R]elevance - the instructor links the instruction to important needs, interests, and motives;
- [C]onfidence - the instructor helps students develop a positive expectation for successful achievement of a learning task; and
- [S]atisfaction - the instructor manages extrinsic and intrinsic reinforcement (Keller, 1983)

Keller (1987) further breaks down each of the ARCS components into three subcomponents. Each of the ARCS subcomponents, their definitions, and examples relevant to library and information skills instruction appear below.

Attention

<u>Perceptual Arousal</u> - providing novelty, surprisingness, incongruity or uncertainty.
Example: Place a brightly-wrapped box with "INFORMATION PROBLEMS" printed on it on a table in front of the learners before beginning the lesson.

<u>Inquiry Arousal</u> - stimulating recall by posing questions or problems to solve.
Example: Introduce an information problem as a "mystery" to be solved and have the students be "detectives" and then provide a some "clues" that will lead them through the process as they search for the solution to their information problem.

<u>Variability</u> - incorporating a range of methods and media that motivates students with varying needs.
Example: After reviewing each of the steps in the research process on the overhead projector, divide the class into teams and assign each team to work through the process using the same information problem. Later have teams compare similarities and differences in their approaches and solutions.

Relevance

<u>Goal Orientation</u> - clearly presenting the objectives and usefulness of the instruction and specific methods for successful achievement.
Example: Share with students the objectives of the instruction and criteria to be used to evaluate their completed research projects.

<u>Motive Matching</u> - matching objectives to student needs and motives.
Example: Allow students to present their projects in writing or orally to accommodate different learning needs and styles.

<u>Familiarity</u> - presenting content in ways that are understood by and tied to learners' experience and values.
Example: Help students understand how developing information literacy skills facilitates their success in the classroom through the integration of these skills with the curriculum.

Confidence

<u>Learning Requirements</u> - informing learners of learning and performance requirements and criteria.
Example: Inform students that they must use a minimum of five different reference sources for their research projects.

<u>Success Opportunities</u> - providing challenging and meaningful opportunities for successful learning.
Example: Provide opportunities for students to practice extracting and summarizing information from various sources before beginning their research projects.

Personal Responsibility- linking learning success to personal effort and ability.
Example: Praise students' understanding and application of the information problem-solving process and attribute it to paying attention, listening, and using critical thinking skills.

Satisfaction

Intrinsic Reinforcement - encouraging and supporting intrinsic enjoyment of the learning experience.
Example: Invite former students to provide testimonials on how learning information skills helped them with homework and class projects.

Extrinsic Rewards - providing positive reinforcement and motivational feedback.
Example: Award certificates to students as they master the information problem-solving process.

Equity - maintaining consistent standards and consequences for success.
Example: Evaluate each completed research project on the basis of the criteria established by the teacher and the library-media specialist.

The ARCS Model is one of the most widely known and applied motivational design models. Most of the research on and development of the ARCS Model has focused on the classroom setting. The following section describes some of the current research on the ARCS Model.

Research on the ARCS Model

Keller (1983; 1987) advocates the application of all four ARCS components to any instructional design because of their relationships to expectancy-value theory. He suggests that the Attention and Relevance components help illustrate the value of learning while the Confidence and Satisfaction components help build expectations for successful learning. Some evidence supporting this assertion was found in a research study by Small and Gluck (1994) that examined each of the ARCS components and a group of 35 effective instructional attribute terms. They found significant relationships between the Attention and Relevance components and between the Confidence and Satisfaction components.

Newby (1991) used the ARCS Model as a framework for categorizing various motivational strategies used by elementary classroom teachers. He found a strong positive correlation between the number of relevance strategies used by teachers and on-task student behaviors but a negative relationship for satisfaction (both reward and punishment) strategies; yet, he discovered that over 58% of the motivational strategies teachers used were satisfaction strategies while relevance strategies only accounted for about 7% of those employed.

Small, Dodge, and Jiang (1996) used the ARCS Model to classify instructional episodes that college students described as either interesting or boring. They found that attention and relevance strategies accounted for more than 75% of the motivational strategies students considered most effective for stimulating interest and reducing boredom.

There is no precise formula for prescribing the number of motivational strategies required for each instructional situation. We do know that too few strategies result in learning boredom and too many strategies create learning anxiety (Keller, 1983). To identify that optimal amount of motivational strategies, a number of contributing factors must be considered. Some of these are students' age, needs, incoming skills, knowledge and attitudes, initial motives including attention readiness, perceptions of relevance, felt confidence, and satisfaction potential (Keller, 1992), the inherent motivational appeal of the content to be taught, the amount of time allocated, and the availability of required resources and technology. Research is needed to identify which motivational strategies are most effective with specific information problem-solving skills and to explore the impact of the various contributing factors cited above on the acquisition and use of library and information skills.

The Time Continuum Model

Although Keller's model prescribes specific strategies to use, it does not indicate *when* in the instructional process to use them. Another motivation model developed by Wlodkowski (1981), the Time Continuum Model, identifies six major motivational factors (attitudes, needs, stimulation, affect, competence, reinforcement) and organizes them within a time frame. The Time Continuum Model specifies three time periods (beginning, during, ending) for any instructional episode and prescribes general actions an instructor should take to ensure motivated learners. These specifications include:

- at the beginning of the instruction the instructor should use strategies to meet student needs and guarantee positive attitudes,
- during the instruction the instructor should incorporate strategies that maintain student involvement and commitment within an emotionally supportive learning environment, and
- as the instruction comes to closure the instructor should employ strategies that affirm student competence and reinforce self-confidence.

While the ARCS Model focuses on the selection and amount of strategies, the Time Continuum Model focuses on the sequence of strategies. As a result, the two models may be easily integrated and applied. The next section of this paper illustrates how the ARCS and Time Continuum Models might be integrated and applied to library and information skills instruction.

Integration and Application of Motivation Models

Once the type and number of motivational strategies are selected for inclusion in the lesson or unit, those strategies can then be organized along Wlodkowski's timeline. The hypothetical lesson plan below illustrates one way to sequence the ARCS motivational strategies described earlier in this paper.[1]

Beginning

- Place a brightly-wrapped box with "INFORMATION PROBLEMS" printed on it on a table in front of the learners before beginning the lesson. (ATTENTION: Perceptual Arousal)

- Introduce an information problem as a "mystery" to be solved and have the students be "detectives" and then provide a some "clues" that will lead them through the process as they search for the solution to their information problem. (ATTENTION: Inquiry Arousal)

- Share with students the objectives of the instruction and criteria to be used to evaluate their completed research projects. (RELEVANCE: Goal Orientation)

- Inform students that they must use a minimum of five different reference sources for their research projects. (CONFIDENCE: Learning Requirements)

- Invite former students to provide testimonials on how learning information skills helped them with homework and class projects. (SATISFACTION: Intrinsic Reinforcement).

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[1] Lessons would, of course, contain more or fewer strategies for each of the ARCS components, based on a thorough analysis of the instructional situation.

During

- Help students understand how developing information literacy skills facilitates their success in the classroom through the integration of these skills with the curriculum. (RELEVANCE: Familiarity)

- After reviewing each of the steps in the research process on the overhead projector, divide the class into teams and assign each team to work through the process using the same information problem. Later have teams compare similarities and differences in their approaches and solutions. (ATTENTION: Variability)

- Provide opportunities for students to practice extracting and summarizing information from various sources before beginning their research projects. (CONFIDENCE: Success Opportunities)

Ending

- Allow students to present their projects in writing or orally to accommodate different learning needs and styles. (RELEVANCE: Motive Matching)

- Evaluate each completed research project on the basis of the criteria established by the teacher and the library-media specialist. (SATISFACTION: Equity)

- Praise students' understanding and application of the information problem-solving process and attribute it to paying attention, listening, and using critical thinking skills. (CONFIDENCE: Personal Responsibility)

- Award certificates to students as they master the information problem- solving process. (SATISFACTION: Extrinsic Rewards)

Research on the motivational design of library and information skills instruction is needed in order to identify (1) which strategies are most appropriate, (2) how many strategies are appropriate, and (3) at what point in the instruction a particular strategy is most appropriate.

Conclusions and Recommendations

Previous research on motivational design has focused mostly on classroom teachers or on student outcomes. There has been little research that focuses on identifying appropriate motivational strategies for library-media specialists to use to teach library and information skills. Studies that identify the motivational requirements of this instruction are essential for helping library media specialists develop ways to (1) stimulate and encourage intellectual curiosity and ongoing information seeking and exploration and (2) successfully integrate library and information skills with the curriculum.

Based upon the previous research presented in this paper, the following future research on motivation in a library and information skills instructional context is recommended:

- Determine how the use of motivational instructional strategies influence elementary and secondary student motivation to solve their information problems.
- Identify parts of the information problem-solving process in greatest need of motivational strategies.
- Investigate ways to make the uncertainty of the research process more positive than negative.
- Determine which motivational strategies are most effective with different types of students and content areas.
- Explore what types of motivational strategies encourage on-task behaviors and enjoyment of the research process.

This paper has described some motivation theories and models and has presented ways in which those theories and models might be applied to library and information skills instruction. A number of potential areas of research related to library and information skills instruction have been highlighted. Such research may provide information on how to create learning environments which motivate students to explore their world.

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Ruth Small, associate professor in the School of Information Studies at Syracuse University, received her doctorate in instructional design, development and evaluation from Syracuse University's School of Education. Her research focuses on the motivational aspects of information use and she is the recipient of AASL's 1997 Highsmith Research Award for her work in this area. Ruth teaches courses in applications of motivational design to information/technology skills instruction, information systems design, and information presentation.

Dr. Small has served as instructional design consultant to a variety of agencies and businesses, such as Motorola, New York State Department of Education, Central New York Regional Transportation Association, National Technical Institute for the Deaf at RIT, Bausch & Lomb, and the International Institute for Management Development in Lausanne, Switzerland. She has evaluated educational and training programs for the Department of Library Science of the University of Sao Paulo (Brazil), Dewitt Wallace-Readers Digest Fund, Miller Brewing Company, Onondaga-Cortland-Madison BOCES, and Craftsman & Scribes Creative Workshop. She is currently co-principal investigator for the Gateway to Educational Materials (GEM) project, funded by the U.S. Department of Education and the National Library of Education; evaluation consultant for the School of Information Studies' Center for Active Learning; and chair of the Educational Advisory Board for "Pappyland," a nationally-broadcast children's television program.

Effective Teaching and Learning Strategies Modeled Through the I-Search: An Inquiry-Based, Student-Centered Research/Writing Process

Julie I. Tallman

Abstract

This paper reports on the effective teaching and learning strategies modeled during an inquiry-based, student-centered I-Search unit taught in a northern Maine high school. The strategies used in this unit helped students form a strong mental model of the research process by emphasizing techniques that increased student interest in learning and perception of information that could be applied to the research question. Time spent by the teacher and media specialist in demonstrating and explaining strategies to the students strengthened student achievement. Their use of questioning techniques encouraged higher-order thinking and aided students in applying information effectively to problem-solving. The result was the successful transfer of a personalized research process and associated skills to succeeding research experiences.

Framing the I-Search Study

The I-Search writing/research process (Macrorie, 1988) is an intriguing recent addition to the research process instructional portfolio of library media specialists and classroom teachers. For library media specialists who have been looking for the ways to encourage students to create their own personal research process, the I-Search seemed to present a possible solution. Delinger (1989) claims that the I-Search "perfectly mesh[es] the two concerns of mastery of tools of inquiry and mastery of modes of discourse." With the I-Search according to Anderson (1990),

> Unintimidating research procedures allow students to tap their inner resources of knowledge, personal experiences, and opinions--however formed--and encourage the development of voice in their writing. Synthesizing research findings with those inner resources builds students' confidence in themselves as thinkers, learners, and writers."

Other articles, including Zorfass and Copel (1995) and Persky (1992), confirm the I-Search's power for students. Zorfass and others (1991) were involved in a five year, government funded study of the I-Search as a tool for integrating technology in the instruction of handicapped children at the middle school level.

Originally developed by Ken Macrorie at the University of New Hampshire to strengthen the writing abilities of his first year composition students, the I-Search has been adapted by a number of K-12 teachers for the writing process and now library media specialists who advocate its research process strengths. This paper focuses on the ninth-grade I-Search experience taught by a media specialist and English teacher in northern Maine.

After an I-Search unit was completed in 1994 at Stearns High School in Millinocket, this researcher asked to study the process from the perspective of a professional educator interested in teaching successful research strategies to future media specialists and from the perspective of a scholar continually interested in her own research process. I designed the study in the form of an heuristic inquiry that emphasized connectedness and relationship with the research process as defined by the I-Search. Although the study had elements of a phenomenological study (Moustakas, 1994), it also included emphasis on students' understanding of what they had experienced and my intuition and tacit understanding of what they were saying about the process. The study focused on the lived experience of students and teachers during their I-Search unit as seen through their perspective (Moustakas, 1990).

The study centered on these key questions: Did students create their own meaningful research process? Could these students recreate their research process by explanation to me or by actual replication in a later research project? I used on-site interviews with the class of ninth-grade students, their teachers, the media specialist, and others in the school, as well as the diaries and I-Search papers from the students as data for triangulation. The interviews had a set of general questions but generally flowed from the students' stories about their I-Search experiences. I searched for meaning in what the students said that either confirmed or dispelled these questions. These students told their stories with a surprising passion about their experiences as did their teachers. I heard about changed lives, enriched lives, proud parents, personal triumphs, and greater understandings about who they were. I came away from this experience greatly affected by these stories about the what the I-Search had meant for some of these students.

The I-Search at Stearns High School

The media specialist and classroom teacher in this high school were not unusual in being tired of student reports that were little more than direct quotes from an encyclopedia. They were looking for a way their students could learn more effective information access and use skills. When the media specialist discovered the I-Search, she persuaded her colleague to try it with her class instead of the traditional research approach. The media specialist thought the I-Search would provide the means for students to develop a good personal research process.

To promote interest and provide a strong internal motivation, Macrorie designed I-Search to revolve around the student's choice of a personally compelling topic. According to Lumsden (1994), a topic from their personal lives and/or interest areas motivated students to use more logical information gathering strategies, to employ strategies that demanded more effort, and to process information more deeply. This motivation arose from their own need to answer their concerns, questions, and information needs. They readily absorbed and used the research strategies that helped them accomplish their goals.

Most of the students in the Maine class found a personal topic or strong interest area they would research (career choices, personal beliefs, family history, health problems, consuming hobbies), but some students lacked an "itch" for a specific topic and chose a "hot" topic through a media center search (Bermuda Triangle, UFOs, cults, etc.). In this situation students who chose a personal topic had a much stronger ownership of their topic and a greater pride in the quality of their search and resulting product. Those who did not have strong ownership in their topic developed increasing boredom with the unit, tended to skip important steps in the process, and took unproductive shortcuts to finish their work earlier. As a result, they were not as happy with their product and received grades generally lower than the students who owned their topics.

The students who owned their topics became the experts in the subject and shared their results with enthusiasm. For example, Ann learned why light made her eyes hurt so much. Sarah investigated the disease that killed her grandmother and found out it was not hereditary. Joe explored his Native American heritage. His father, separated from his family, helped him find out about his culture and ancestral history. Bryan discovered why his autistic cousin, close in age, behaved so differently. Already proud of his ice-fishing prowess, Nick learned about intriguing new techniques that he would have to test before he believed they would work. Debra realized "how I really felt about my adoption. . . . I think that's the neatest thing for me." Then there was Mike who said, "If I pick my topic, I [will] do a good job on it. If you prepick a topic for me, and I don't like the topic, I'm not going to do a good job. It's something I'm not interested in. I have to be interested in it to do it."

Telling the search story in first person, also a requirement of the I-Search process, gave these Maine students the freedom to put their own thoughts and analysis into their report. The writing prompts, "I think" and "I feel," allowed students to use their own thinking to tie concepts and reasons together in problem-solving. This requirement proved especially difficult for students with topics unrelated to them personally. Some of them recognized the reasons for their difficulty, mostly their unwillingness to spend the time or thought on something that bored them.

Having such interest in their topics also meant most students voluntarily pushed themselves to a new level of thinking about their topics. However, a few recognized the need for more work than they were willing to do. Simon wanted to stick with facts because he did not have to be creative--"too much work! . . .The creativity came in when [I] had to put the I in and that's what hurt [me]." His colleague liked her old paper writing habits better: "I don't do a lot of preparation before I write my paper, I just like to write it, and just get it over with. I'm so used to doing it the other way . . . that to put myself in it and say what I think about was hard."

Telling the story of one's search was as much a part of the final product for the I-Search as deciding on what information applied to the research questions. Each student reflected on the search process and commented on the search strategies that worked or did not work and why. Through this conscious acknowledgment, students recognized the successful strategies that could be used for other research projects. Inclusion of this thinking in the I-Search report also provided the teacher with a clear idea of the process taken by the student, what the cause/effect relationships were with data collection and reporting, and why the final report or paper took the form it did. This information put the evaluation emphasis on the process.

The Maine class wrote an I-Search paper and gave oral reports as their final products. All papers had to include the following four discussion parts:

- what I want to know about my topic
- why the topic is important to me
- the story of my search for information
- how I have applied the information I found to answer my question.

The I-Search process evaluation validated all the steps used in the search process. Content evaluation was based on how effective students were at including the four important discussion parts, putting the "I" into their reports, and presenting their product. This validation demonstrated to students that all aspects of the I-Search were important, not just the final product.

Teaching Strategies

The I-Search provided multiple opportunities through its inquiry-based approach to use a variety of teaching strategies to help students form a strong mental model of their research process. It gave students the means to:

- absorb good research strategies
- refine their ability to choose and apply information to their problem
- increase their critical thinking skills such as reasoning ability
- increase their self-confidence for research and writing
- have the opportunity to celebrate their new learning experiences.

The cooperating teacher and media specialist built their teaching strategies approach toward the goal of each student recognizing a successful, personal research process that could accommodate future problem-solving needs through expansion in a variety of directions. They purposefully combined demonstrations, explanations, models, debriefing sessions, interventions, conferences, and a variety of questioning techniques to achieve their goals.

Because of the uniqueness of the writing/research connection through the I-Search, several teaching strategies were centrally important to the I-Search for its success. Taking place over nine-week period of the second quarter, the unit was divided into four areas: choosing the topic, finding information, using information, and writing the I-Search paper/product. The media specialist would introduce the research strategies, then both would conference with individual students to ensure an appropriate skill level to use the strategies. Both teacher and media specialist agreed that the unit could have been shortened and/or other work inserted during the unit to give students a change of pace and time to reflect on their research. When questioned, students indicated that they preferred the latter option.

Choosing the Topic

Choosing the topic defined the level of topic ownership students claimed. A few students could not identify possible topics without help and had confused feelings about what they should be doing. For these students, adding key words about family, hobbies, interests, problems, events, or school happenings to the circles drawn in a web-like graphic gave them a visual picture of their lives. Looking like chunks of interest areas with connecting sections to a center point (themselves), the various parts of the web represented possibilities for an I-Search exploration. Filling in the information at various points on the web enabled them to see how pieces of information about a subject or topic fit together into the whole of their learning life. A demonstration webbing exercise by the teacher and the media specialist clarified misunderstandings about what the web-like graphic would look like when students finished.

Some students still needed further help in choosing a topic. They received guidance in the use of electronic indexes, tables of contents in reference materials, and good browsing materials in various subject areas. Then they read general background material for several days to obtain enough of a grasp of the content area to refine the topic choice to specific questions. These teaching strategies ensured that students had strong skills in using electronic indexes and tables of contents through in-class exercises. Inclusion of these skills at this point also meant that they were part of an authentic activity that was meaningful to the individual student.

Finding Information

When everyone had a topic or an idea for a possible topic, the media specialist introduced a pre-notetaking sheet to help students define what they wanted to learn about their topics and focus on information needs. The pre-notetaking sheet was simply a sheet of paper divided into three columns: the first column asked "what I know about this topic?", the second column asked "what I don't know about this topic?", and the third column asked "what I want to answer in my research." By identifying what they knew and did not know about a topic, students turned that information into their own research questions. When students did not have enough background information about their topic, filling out the pre-notetaking sheet before and after the background reading sessions provided the opportunity to think clearly about what they wanted to know. The pre-notetaking sheet proved an effective tool for helping students develop strong research questions.

The teacher and media specialist also used this time to teach students about skimming and scanning information from reference sources as well as general reading sources. Then they taught students how to construct a bibliography to record the sources they used and wanted to use during their research and how to record their research investigations and findings in a journal.

The journal was to contain notes about the information students were finding as well as reflections on the research strategies they used. During this stage of the project, the students read broadly without notetaking. At the end of each class period, they reflected about what they had read on their topic in their journals. They were not allowed to refer back to the material or keep notes while they were reading in order to think about their topic without the usual notetaking crutches. The reflective reading strategy had the effect of forcing students to put their reading results into their own words and relate the information to their questions. This metacognitive exercise was a very difficult task for some students but gave them knowledge about how to think about a topic, recognize their own insights, and put their new knowledge into their own language.

As a result, Sarah commented on learning to understand the material as being important to her. She remarked to this researcher that, "Before I would just read it and I didn't really think about it. It just made me think about it and put it in my own thoughts." After finding the assignment helpful, John reported that, "You need to read and know some things before you can write about it." Larry also thought the assignment for reflective reading was very effective, "This time we had to think about what we were doing. . . . We had to put it into our own words and that was a big change from what we had to do before."

Students also shared their topics with their peers. Students in the class connected topics they heard with people or friends they knew who had an interest in their topic. For example, they knew other students who were adopted or their parents had friends who had adopted children and might be available for interviews. The teacher knew a colleague who had a hobby related to another one of the questions being investigated and helped her student set up an interview with the other teacher. The guidance counselor and the media specialist acted as connections with community resources available for interviews or discovery by students for their projects.

Interviewing local experts, family members, teachers, peers, people on the Internet, World Wide Web, conference calls, faxes, contributed to the richness of the resources available for students to use. Talking about their topics with people familiar to them gave students confidence to use people as resources. Asking for information and advice from new people gave students the opportunity to improve their ability to create questions around a topic, gather information from different sources, learn valuable interviewing skills, and gain confidence in their investigative abilities.

During the I-Search assignment, regular conferences between the student and teacher or media specialist took place as a group or in an individual session. The teacher or media specialist had a checklist of strategies the student had to use in choosing the topic, refining the topic, reporting on the topic in the journal, making a bibliography, and reporting on the results of reflective reading. The journal entries indicated whether the student needed further help in getting away from the cut and paste note-taking style. This also provided an opportunity for the media specialist and teacher to observe whether the research strategies used by the student were successful. They encouraged the student to write about frustrating experiences with their research, e.g. unavailable resources.

Acting as facilitators via the conferences, the teacher and media specialist allowed students to take responsibility for their own learning pace throughout the assignment. They were careful to erect enough scaffolding so that the student did not fall behind. Many students had not previously had the experience of taking responsibility for their own time management schedule and had difficulties keeping on task during the six weeks project. They needed the extra support of deadlines and conferences.

Using Information

To help students reflect about the connection between the information they were finding and their project questions, the media specialist taught students how to make double-entry drafts in their journals. After dividing journal pages lengthwise into two columns, students noted passages that provoked a personal response in the left column of the draft. In the right column, they wrote their response or their questions to those passages. Some of the students commented on learning how to put their opinions into their papers this way. The purpose was for them to ask a question about the material, make a comment about something brought to mind, tie the material to an event or action they had noticed previously, find a disagreement with other resources they had read, or reflect on the new ideas created in their minds. These students expressed the opinion that this strategy was one of the most valuable exercises in the unit. They learned about handling, controlling, and connecting information to their problem-solving.

During this time period, the media specialist taught students how to compare and contrast information for accuracy, facts, statistics, bias, and opinion. She brought newspaper clippings on a particular topic into class and had the students analyze them for fact, slanted information, opinions, second-hand reporting, and innuendo. Students also practiced on articles from popular journals and then their own information sources. This strategy taught students to discriminate among their sources and develop opinions about information validity.

All the information was noted in the students' journals and then used to create the first draft of the I-Search paper. The successes and failures students had in searching for information through interviews or library materials were all mirrored in their journal writing and transferred to the draft. Some students made only minor changes in the organizational structure to turn their journal writing into their first draft. Others had more difficulty with reflective thinking and found their journals less useful for telling their stories. In many respects the usefulness of the journals depended on how much ownership over the topic the students felt they had. The more ownership, the more information in their own language they reported in their journals, the less trouble they had converting the journal to a good paper or story of their search.

One student commented that the I-Search "had to come from yourself and not from a book where you could just copy out of it." His classmate admitted that "you had to think a lot putting yourself into it. That was probably one of the hardest parts." Writing from the first person perspective and giving the self credibility as well as outside sources were unusual experiences for most students. However, the first person perspective gave some students renewed confidence in their ability to write.

Many students claimed they were better writers as well as stronger thinkers because of the I-Search. Alex reported that, "The I-Search paper is totally different than any report I'd ever done before. It strengthened my writing style, especially when I write about myself." His friend learned, "not to take things for face value and . . . to look deeper into things." Deidre responded that, "This time you had to tell how you thought about every aspect of it. So I thought a lot more." For another student, the personal connection made the difference, "It was about my grandmother. It was easy to put myself in it. I did the most thinking when I was putting it together and then how it [her disease] must have affected her. By that time, I was trying to find everything I could on it to see exactly what happened and whether it was going to happen to me."

One of the students felt that, "This type of paper promotes free-thinking and challenges others' ideas." A classmate reported that, "It helped me look more closely at the things I read to see if the authors agreed, or if the statements were just theories or real facts. I think it taught me a lot about how to put things in my perspective, to understand what I am responding to better."

Peer editing taught the students to be more observant of their own writing skills. They noticed their friends having difficulties with the first person perspective and commented on how their friends could make that transition. These students also developed questioning techniques for peer editing sessions that gave constructive direction for making changes without direct criticism. The peer editing experience heightened each student's awareness of good editing techniques for their own papers. Comments such as "I really liked Mike's paper. He told me exactly what it feels like to weld materials together while underwater," created a sense of value and appreciation of their peers' writing. What was happening throughout the unit for all the students was a sense of collaboration with their peers and a heightened interest in their peers' searches.

Strategies For Use Throughout the Unit

Timelines

Over the quarter, tentative deadlines were established by the teaching team at various stages of the process to ensure that students stayed within the unit's time frame, e.g. one week for topic selection, one week for general reflective reading, four weeks for researching sources, and three weeks for writing the paper. Because the I-Search was an individual search process, each student moved along the process at a slightly different rate. The challenge was to keep those unused to time management on task to finish their searches. Regular conferencing with the student provided opportunities for intervention where appropriate or an adjustment in the requirements because of temporary obstacles. The object was to remain flexible in the use of time based on the input of the students.

Frequently, at the beginning of class the media specialist and teacher would ask the class for a status report. Where were they in the process? What obstacles were they encountering? Did they find any aspect of the process confusing? Did they need reinforcement of certain skills before taking the next step? What were their feelings at that point? Why? Was the time frame sufficient? Sometimes more practice in a skill was necessary and could be accommodated quickly. At other times an alternative strategy was offered to provide a different perspective on the skill being taught and practiced.

Student Journals

Student journals also provided constant clues to student progress. The teacher and media specialist would skim them during class work periods and then sit down with students for accompanying conferences. These conferences were especially necessary during reflective reading periods and completion of double-entry drafts because of the difficulty of these skills and the tendency for students to skip them. Asking the students how they thought they could get ideas for their search through the use of these techniques helped them think critically about the use of these skills and apply them more beneficially.

These journals and conferences also gave the teaching team the opportunity to listen to their students. This opportunity was critical for assessing the I-Search experience. When the media specialist and teacher made modifications to help the students, the students knew they had been heard and responded with increasing confidence about the process.

Interventions

Interventions fell into two categories: (1) full-group interventions devoted to content assessment, and (2) individualized interventions for any reason. Critical times for interventions occurred during the webbing, pre-notetaking, and double-entry drafting exercises which required higher order critical thinking by the students.

During the pre-notetaking and double-entry drafting exercises, the teaching team would ask questions to move students from lower levels of thinking on Bloom's Taxonomy (Bloom, 1956) to upper-level critical thinking skills. The team also intervened if students needed help with organization and sequencing. During this time, they discovered that they needed to teach students how to highlight information on photocopies of their readings or make appropriate margin comments. Many of the students did not always know how to make the connection between reading for information and their research questions. Discriminating between interesting information and information specifically applying to their questions required practice by the students and reassurance by the teaching team for the students to stay on task.

Individual interventions also worked well with students who grew overwhelmed by the thought of all the activities to accomplish. Meeting with these students at the beginning of each period gave them the opportunity to set one goal to accomplish during that period to gain a feeling of success. Writing about each of those successes in their journals tracked their accomplishments and helped them recognize they had the skills to undertake a successful research project.

Questions for Peer-editing and Prompting

The emphasis was on positive and constructive support from peers and from the teaching team. The media specialist and teacher encouraged their students to ask higher order thinking questions when they took part in editing their peers' papers. Asking for further explanation, more support, clarification, opposing viewpoints, resource alternatives, alternative problem-solving possibilities, opinions about bias, and next steps created an atmosphere of expectation and forward thinking by the students. They knew they could not stop at the first answer because they would have to justify its choice. The interest of their colleagues was a good reason to investigate further. Collaborative learning provided a major impetus for improved research experiences and writing efforts.

Conference Questions

The goal of conferencing questions during selection of a potential topic was to help students find a focus for their topic. Narrowing down a topic to a specific focus was one of the most difficult tasks of the unit but was helped immensely by the personal interest of the searcher. Students were asked why they selected their topic, what they already knew about it, and what their next step would be.

The goal of conferencing questions during the pre-notetaking exercise was to help students formulate "what I want to answer in my research" questions to guide their research focus. Students were asked about the strategy they would use to generate more research questions:

- what indexes and table of contents were the most helpful and why?
- what obstacles had they encountered and how they had overcome them?
- what would be their next step?

Conferencing questions on content included asking about opposing viewpoints for comparison and contrast. Students had to justify their choice of material in terms of their research questions. They were also asked if they could relate the content to a personal experience to construct additional meaning. The media specialist and teacher asked them to predict what might happen to their problem in the future based on the information they had found. Students were asked to search for faulty logic in their sources or in their own information, cite and explain. Finally, they were asked to suggest solutions for a problem posed in their research, evaluate the solutions, and communicate their findings.

Conferencing questions on process included discussion about the obstacles encountered and how students solved them. Students were continually asked about their next step and what strategy they planned on using and why. They were asked to develop criteria for judging their progress and then do a self-evaluation. They were asked about their time management skills and how they could improve them. Finally, they were asked about suggestions for unit improvement.

Student Reactions to the I-Search

With topic ownership came excitement of discovery and enthusiasm about the experience. Senior students from study halls paid the highest compliment by asking to listen to their younger colleagues tell the stories of their searches. Questions from the audience reinforced the feeling that the ninth graders were indeed the experts in their topics and gave considerable confidence boosts. One young student was able to tell her classmates why she had so much trouble with her eyes and the corrective measures she would take to help herself see when confronted with bright lights. Another student found out he knew more about ice-fishing for the "big one" than any of his peers in this northern Maine community surrounded by many lakes. Students told of new relationships with their autistic cousins and their families, or renewed understanding and appreciation of adoptive parents who helped with the need to know biological background.

Suddenly, the question of whether to use note cards during an oral report or how to keep from freezing in front of an audience was no longer a worry. Students found they could think quickly on their feet; they knew the answers; they had absorbed the material from their research. They could describe the successful parts of the research process they had just finished and they could tell the class why some strategies were not effective for them. Students gained considerable sophistication about successful research strategies for their own use and could reflect on the merits and disadvantages of the ones they had tried.

Connections Between the I-Search Strategies and Effective Teaching

Learning Growth

The collaborating teaching team in this case study modeled a number of teaching strategies for encouraging learning growth through their lesson design, demonstrations, and questioning strategies. These strategies directly connected to the following learning theories (Dede, 1990):

- Learning is evolutionary.
- Learners interpret instructional experiences using their own mental models.
- Learning that is active and constructive is best remembered.
- The ideal environment for learning is not static.
- Beliefs and attitudes of the learner can determine learning outcomes.
- Each learner has a unique style of learning.
- Ideally, learning should take place in an environment that models the environment in which the knowledge will be used as closely as possible.
- Interdisciplinary approaches in presenting subject matter are more effective than fragmentation.
- Learning requires time for ideation and reflective thinking.
- Good teachers are learners who facilitate student growth.

Each of these points applied to the events of this I-Search and emphasized the power of the I-Search for inquiry-based student learning. By reflecting on research strategies that worked for them, students built a research process that could change effectively for different problems and assignments. They formed their own mental models of what a good research process was for them. Students saw the results of the assignment through the amount of general satisfaction they had with the assignment not just by the grade given by the teacher.

Regardless of how successful the I-Search was, each student was actively engaged throughout the unit using various strategies and was asked to reflect on these strategies in her/his personal journal. At no time was the unit static. All activities had been placed in a context relevant to what might take place for a problem-solving situation in everyday life outside of school. As students discovered new information or changed the research question in any way, they also discovered the I-Search's flexibility. Joe was not happy with his paper on his Native American heritage at the start of the holiday period that was meant as a reflective time on his topic. When he saw his dad during the holiday, he asked for and received extra help from both his dad and his sister. Consequently, he gained more detailed information. His sister sent him books from the tribal library. Joe's focus changed from a broad perspective of his tribe to a more intimate picture of the meaning of tribal life for him and his family in a contemporary society.

It was easy for this researcher to see that each student responded a little differently to the I-Search unit, its strategies, and its results reflecting the individualized nature of the research process. Some of the difference in response came from a difference in response to problems or beliefs. For example, one student did an I-Search on abortion. Her original intention had been to lay the problem before her peers from a pro-life perspective. She wanted to use the opportunity as an anti-abortion forum and was quite outspoken about her purpose. Her search took her into both pro- and anti-abortion literature. After her teacher asked her to compare and contrast and apply critical analysis to the information she found, the student was much better prepared to respond to questions with answers backed by critical thinking. Her paper was more scholarly and inclusive of literature that looked at abortion from both sides of the debate.

Unique styles of learning also took a central role in the I-Search. The underwater welding student told the interviewer that he was not a student in the sense of good booklearning abilities. He needed to work with his hands and prided himself on his ability to translate demonstrations of physical actions. The paper product for his I-Search was not of high quality but the resulting knowledge, interviewing expertise, and enthusiasm for welding led the high school welding teacher to place him in his welding classes as a ninth-grader when the class was normally reserved for eleventh-graders. His research skills and achievements had been validated in this process. Other students were excellent book learners and created articulate arguments for specific solutions to their questions. All types of learners found an outlet with the I-Search. Part of their success depended on the freedom they had to use and acknowledge legitimate research strategies that worked for them.

Certainly, the I-Search placed students in an environment where answers and solutions they developed from their searches could be related to their own lives, families, or futures. Most of their I-Search personal topics centered on career, health, hobby, and relationship topics, all topics relevant to their lives outside of school. The environment surrounding their searches was authentic. There was also no doubt that the kinds of questions students or teachers asked promoted an interdisciplinary investigation. By using a variety of research methodologies and resources crossing content lines, the I-Search stretched student understanding of the word and meaning of resource and library media.

The techniques used to push student thinking beyond the basic knowledge and information acquisition level to thinking about ideas and solutions came through the reflective reading exercises, the double-entry drafts in their journals, the journaling process, the requirement to construct written statements using the first person perspective, and the writing prompts of "I feel" and "I think." The use of interventions and conferences while students were using the research strategies, acquiring relevant information, and applying it to their research questions meant that all students received the attention necessary for them to grow in the process. When a strategy was not effective for a particular student, the teacher and/or media specialist switched immediately to an alternative strategy to help the student understand and apply an adaptation of the suggested technique. This teaching team watched and interacted with their students in ways that enhanced their capability to integrate the I-Search into their own teaching repertoire.

Teaching strategies

The media specialist and teacher used a variety of strategies to capture students' interest in learning, self-confidence, perception of what was important, aptitude for reasoning, and connections with prior achievement. The experiences on which students could build, home and social life, cultural background and ethnicity, and their special needs, were all variables on which students differed (Cangelosi, 1992, p. vii). By the time this researcher had the chance to observe the unit, the teacher and media specialist had:

- refined their learning goals for their students
- specified objectives that would allow their students to reach those goals
- installed mechanisms for monitoring student progress and utilizing feedback and
- started to build a reputation for strong closure with the oral reports before invited guests, all part of effective teaching (p. vii).

The formative evaluation ongoing throughout the unit depended on the debriefing sessions and conferences, both whole class, small group, and individual. These experiences revolved around questions for the students to think about and respond to in their journals as well as discuss orally with their peers and the teaching team. A strength of these questions was their divergent nature that allowed both analysis and multiple answers from the students.

Some of the questions came with prompts to start students thinking but not so directive as to steer the students into rote answers. Research literature indicates that prompting is a very important and effective technique (Jacobsen, Eggen, Kauchak, & Dulaney, 1985, p. 157) but is difficult to employ. Many of the prompts would happen as the teaching team listened to students' respond and recognized where they were having difficulty in expression or thinking processes. Jacobsen, Eggen, Kauchak, & Dulaney (1995, p. 157) suggest that "prompting can only be practiced in the context of an actual lesson and a prompting question is formed and asked 'on the spot,' following a student response." That is what occurred most of the time with this unit.

One of the strengths in having students keep a journal with their notes and reflections along with the story of their search successes was the opportunity for the teaching team to probe students for more depth in their responses. To question students about their findings and to guide them in their use of their findings, the teacher and media specialist used verbs that focused on higher order thinking. They challenged the students to:

> analyze, recognize, examine, simplify, discern, compare, determine,
> assess, decide, judge, prioritize, diagnose, accept/reject, combine,
> and re-organize

These verbs used in good question prompts gave students a means of digging deeper into their thoughts about the relationship of the material they were finding to their topics. This intervention during the process enhanced both the skills that the students gained and the product at the end of the process.

Throughout the I-Search unit, the teaching team demonstrated and explained research techniques and strategies and modeled the way they worked for collecting data and reflecting on the results. According to Cole and Chan (1994, p. 124), "research studies have shown that if teachers spend considerable time providing demonstrations and explanations then high student achievement is a likely result." Some of the concepts, strategies, and techniques were strange to the students because of their difference with the more traditional methods of research. Thus, this teaching team found themselves having to take care in presenting the strategies with solid examples and models that allowed the students to grasp the reasons for using the strategies with the expected results. They discovered that double-entry drafting, for example, needed much explanation, practice, conferencing, and examples to give students confidence in its use. However, once understood, it became one of the best research tools in their process.

Although the teaching team did not do this in the case study observed, they suggested that when they wrote an I-Search paper at the same time as the students, the modeling was extremely effective. They found it most instructive for themselves as well as their students. The opportunity to discuss strategy failures as well as successes and receive peer input on their process provided them the opportunity to stress the most important features of their process, and restructure where they saw weaknesses, important to effective teaching according to Cole and Chan (p. 143).

The I-Search experience gave the teaching team an unusual opportunity to explore a variety of questioning techniques to foster learning. They used questions to facilitate peer communication about their experiences during the I-Search and to generate more focus on particular findings students were overlooking as evidenced by their journals and conversation during conferences. Finally, they asked the what, when, how, who, and particularly the why questions that according to Cole and Chan (p. 172), were the "most challenging of all because students have to understand causal relationships before they can answer these questions correctly."

The variety and effectiveness of the teaching strategies and techniques clearly made the I-Search unit as taught in this high school a strong research foundation. The I-Search process moved these students to better research habits by constructing an environment that forced them to think and dig for appropriate information, then write about it from a perspective that made them value their own opinion and include themselves in the critical analysis process. Teachers having students who had been through the I-Search unit in previous years proclaimed its success. They remarked on how they could tell I-Search students from the others by watching them approach a new research assignment. The I-Search students had their process and knew exactly how they were going to approach the problem. The non I-Search students spent much more time in a state of confusion and wanting more help. These teachers also appreciated that they could expect I-Search students to respond satisfactorily to a more difficult research assignment. In return for the increased enthusiasm from the teachers, students worked on their higher level assignments with greater interest and more concern for a quality product. Clearly, these students had transferred the research and information strategies they had learned during the I-Search into a personal research process they could use and build upon in later assignments.

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TM6 was extremely valuable as a forum for the consideration of the roles and responsibilities of the library media specialist for the next decade. Knowing where we have been and where we are will enable us to form a vision for where we want to go in the future.

The Cognitive Apprenticeship Model and Adolescent Information Use

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Abstract

This paper outlines a proposed research agenda investigating the application of the cognitive apprenticeship model of instruction (Collins, Brown, & Newman, 1989) in facilitating adolescent information use. Current research indicates adolescents have difficulty in writing tasks. These tasks require many of the same higher-order thinking skills inherent in information use. Literature from the library and information science community on adolescent information seeking has largely neglected the area of information use and methods to guide and evaluate information use. The appropriateness and applicability of the cognitive apprenticeship model to facilitate adolescent information use is discussed along with particular instructional techniques which we propose to test.

Background

Findings of the 1992 National Assessment of Educational Progress (Applebee, et. al., 1994) demonstrate that only 3% of students evaluated in grades 4, 8, and 12 in the United States are able to compose a well-developed written argument. Under a fourth of these students at any level were able to write persuasively beyond a minimal level of development on multiple tasks. Despite the enthusiasm for teaching information literacy, a literacy which emphasizes the application of information to meet the requirements of a task, and despite calls to change the nature of composition assignments in secondary schools, something is still amiss.

The structure of precollege writing assignments does not challenge students to argue from or to apply reading (Higgins, 1993).One assignment typical of this is the research paper, a task often given to secondary school students. Ostensibly it gives students an opportunity to create an argument, that is to establish a position using rational support which extends down to specific factual evidence (Fulkerson, 1996); however, the product of these assignments is often much different than that which is intended. Students tend to organize writing goals around topic-driven, fact-finding strategies instead of around information transforming strategies (Nelson, 1993). Bereiter and Scardamalia (1987) consider these to be knowledge-telling strategies which have evolved and persisted because the assignments accommodate students' cognitive coping strategies. Often teachers encourage the persistence of these strategies by evaluating lower level skills and passing students who show evidence of organizing facts even though they do not demonstrate analysis and synthesis skills (Bereiter & Scardamalia, 1987).

Students' papers resulting from these strategies and the assignments which encourage them fail to incorporate critical thinking skills; cut-and-paste can never be synonymous with analysis and synthesis. Assignments such as these, which address erroneous or short-term goals, might encourage students to foster false metacognitive beliefs about the nature of learning (Paris & Winograd, 1990). While research papers as they are traditionally assigned and evaluated may provide students with practice in organizational skills and information seeking skills, they neglect the higher order thinking skills which go hand-in-hand with information use. Changing the assignments we give is a small step in correcting this problem; however, changing the way we teach information use may provide a better solution.

An Emerging Research Agenda

Callison (1993) has suggested that teachers and media specialists work to create fluid roles for themselves in the classroom which are designed to give students the opportunity to observe and practice information use as higher order thinking. He contends as does Woolls (1997) that cognitive apprenticeship can provide an invaluable framework for the evaluation of strategies to improve the information use as higher order thinking skills of adolescents. What is important to library and information science researchers today is "to know how to improve the ability of students to find, synthesize, and correctly apply information" (Craver, 1990, p. 130); that is, we must determine what the specific strategies are which can be utilized through the entire process from search to application.

In establishing a research agenda which is focused on the need to improve adolescent information use, we are centering our inquiry on the following questions:

1) What strategies can be utilized within a framework of cognitive apprenticeship to improve the information use skills of adolescents in the academic task normally described as the research paper?

2) Who is responsible for implementing these strategies to ensure their effectiveness in improving students' information use? To what degree is the responsibility shared among teacher, media specialist, parent, and students, or is it unique to one group, or does responsibility vary across strategies?

The following definitions are assumed:

> <u>Cognitive apprenticeship</u> (CA) is a method of teaching and learning based on traditional apprenticeship. In CA, the teacher has three tasks: model, coach, and fade. Underlying these tasks are the assumptions that the teacher describes his or her metacognitive processes in performing a skill and that the teacher provides the student with scaffolded practice in performing that skill. The social nature of learning is emphasized as is the need for continual assessment.
>
> <u>Information use</u> refers to the application of higher order thinking skills such as analysis and synthesis employed in information retrieval and processing which support a specific academic purpose such as a research paper.
>
> <u>Research papers</u> are teacher-directed writing assignments which require students to locate and examine a body of information in order to glean or extract specific information which can be restated, rephrased, restructured, or rearranged to meet a specific goal.
>
> <u>Adolescents</u> are students enrolled in a secondary (grades 9-12) school.

In large part, research concerning adolescents and information within the library and information science community centers on information seeking. Perhaps the most cited example of this is Kuhlthau's (1991; 1993a; 1993b) longitudinal study of information seeking which followed a group of advanced placement high school seniors as they made the transition from high school to college. Her research led to process model of information seeking which has joined similar models (Eisenberg & Berkowitz, 1990; Stripling & Pitts, 1988; Joyce & Tallman, 1997). While Kuhlthau's work is key, it overlooks what happens once the student has located a particular information source.

Kuhlthau, however, senses the need for teachers and media specialists to be more active participants in students' information seeking and use. In *Seeking Meaning* (1993b), she addresses the issue of mediating, that is assisting, guiding, enabling, or otherwise intervening in, a students' information search process. Although her view of mediating is primarily concerned with addressing issues in information seeking, Kuhlthau does recognize that information use is inseparable from information seeking. Her vision of holistic mediation and education entails the mediator assisting the student with seeking meaning (recalling, summarizing, paraphrasing, and extending) as well as counseling students "in interpreting information to address an evolving problem" (1993b, p. 151). In relating this intervention to Vygotsky's zone of proximal development, Kuhlthau begins to move her vision of mediation closer to the idea of cognitive apprenticeship. It is our objective to apply the cognitive apprenticeship model in more detail.

While Kuhlthau is quite clear about the need for intervention and the overall shape of the intervention, she is less clear about the specific strategies which would be appropriate. A number of potentially useful strategies has been suggested in research on composition, but they remain untested in the library and information science literature. Because many of these strategies are directly related to improving students' abilities to analyze and evaluate information in order to create a successful argument by building coherent strings of evidence and by making logical and supported claims, we propose evaluating these strategies to measure their potential to improve adolescent information use.

The Cognitive Apprenticeship Framework

Four approaches dominate the literature on composition instruction (Hillocks, 1986):

> Presentational instruction is characterized by the teacher presenting information to a class primarily in the form of lecture or through texts. The teacher determines objectives, creates assignments, and establishes evaluative criteria.
>
> Natural process instruction is characterized, not by teacher authoritarianism but, by student freedom. Students choose their own topics, get feedback from peers, and revise writing to meet their own criteria.
>
> Conference instruction is characterized by a series of individualized writing conferences between teacher and student.
>
> Environmental instruction is characterized by a balance among teacher, student, task, and materials. Inquiry, student-led groups, and establishing common criteria for evaluation are important elements of this type of instruction.

Hillocks' findings are surprising . Students taught under presentational modes made negligible gains in writing, while students taught using environmental strategies significantly outperformed all others. Cognitive apprenticeship is one instructional model which matches what Hillocks describes as environmental instruction.

Cognitive apprenticeship has been explicated most usefully by Collins, et. al. (1989). They describe CA as a teaching strategy which, like traditional apprenticeship, "embeds the learning of skills and knowledge in their socially functional context" (p. 454). In CA,

> the apprentice repeatedly observes the master executing (or modeling) the target process, which usually involves some different but interrelated subskills. The apprentice then attempts to execute the process with guidance and help from the master (i.e. coaching). A key aspect of coaching is the provision of scaffolding, which is the support, in the form of reminders and help, that the apprentice requires to approximate the execution of the entire composite of skills. Once the learner has a grasp of the target skills, the master reduces (or fades) his participation, providing only limited hints, refinements, and feedback to the learner, who practices by successively approximating smooth execution of the whole skill. (p. 456).

This description of instruction stands in stark contrast to the presentational or natural modes of instruction Hillocks describes. Teachers and media specialists often rely on these less effective modes of instruction hoping that either by the instructor's sheer force of will or through students' innate abilities, the skills of information use can be imparted. Clearly, gains in thinking and understanding are not made so easily.

The relationship between apprentice and master, or student and teacher, depicted in the description above builds directly on the work of Vygotsky (1978) in its emphasis on the social and dialogical nature of learning. Vygotsky believed that learning is an inherently social process which can be encouraged through dialogue within the zone of proximal development. He defines this zone as:

> the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky, 1978, p. 86).

For Vygotsky, individual ability is less effective than combined ability. Through dialogue between student and teacher or between student and peer, the student can be encouraged to reach new levels of learning.

Vygotsky (1986) believed that written language most fully supports the development of higher cognitive functions. Consider what Collins, et. al. (1989) say about writing:

Students are unable to make use of potential models of good writing acquired through reading because they have no understanding of the strategies and processes required to produce such text. Stuck with what Bereiter and Scardamalia (1987) call 'knowledge-telling strategies,' they are unaware that expert writing involves organizing one's ideas about a topic, elaborating goals to be achieved in the writing, thinking about what the audience is likely to know or believe about the subject, and so on. (p. 455).

Through teacher modeling, students develop a richer conceptual model of the task to be performed which serves as both an advance organizer and a guide for feedback. It is also important because it serves as a gateway to the development of higher order thinking skills development. This makes cognitive apprenticeship appropriate to teaching information use because in K-12 environments; traditionally, students seldom have an opportunity to see teachers and media specialists engaged in information use and therefore have an inadequate model to guide their own information use (Pitts, 1994). Students may see a finished project such as an assignment sheet, a pathfinder, or even a sample composition, but teachers and media specialists seldom allow students to observe the mental wrangling that goes into the production of these items.

The teacher's explication of his or her metacognition is another important aspect of cognitive apprenticeship. Metacognition can be regarded as knowledge about cognitive states and abilities which is sharable (Paris & Winograd, 1990). Sometimes, however, metacognitive skills may be perceived as "inaccessible" leading individuals to work alone (Rogoff, 1991); consequently, in classroom instruction, teachers may ignore discussing their metacognition. When teachers and media specialists neglect sharing this knowledge, they change the research paper into an activity where it is incidental items such as bibliographic form, preliminary outline, and internal citation which receive higher value than the ability to demonstrate the critical use information (Mancall, Aaron, & Walker, 1986); it is the apprenticeship of form instead of function.

Because they have observable components, writing and information use are perfect points for teachers and students to begin a dialogue about cognition and metacognition. This coinvestigation leads the student's conceptualization of the skills and processes which are to be acquired and it allows teachers, media specialists, and students to talk together about the decision-making processes in writing and information use. It is important though that discussions move beyond observables into the realm of metacognition, lest students become trapped only by what they see (Bereiter & Scardamalia, 1987). It is also important to understand that cognitive coaching alone is not sufficient to create change in the strategies, skills, and processes students employ (Bereiter & Scardamalia, 1987; Collins, et. al. 1990); students must also be given the opportunity to practice these skills as well as develop their own metacognitive abilities.

Within the cognitive apprenticeship model, skills practice is designed in a scaffolded manner. About scaffolding, Greenfield (1984) writes: "it provides a support; it functions as a tool; it extends the range of the worker; it allows the worker to accomplish a task not otherwise possible, and it is used selectively to aid the worker where needed" (p. 118). What is important to remember is that scaffolds are temporary structures; they are not designed as a crutch, but as a tool for encouraging growth. The implications of scaffolding within the context of information use to create a research paper or any other end product are that teachers and media specialists cannot leave students to their own wits once the assignment is given. Scaffolding creates a shared understanding among teacher, media specialists, and student of the goals of information use as well as a shared understanding that collaboration is essential to success (Langer & Applebee, 1987).

Encouraging students to improve their ability to evaluate and to manage their own cognitive skills, the essential tasks of metacognition (Paris & Winograd, 1990), is an important component of cognitive apprenticeship. Students acquire more control over their information use strategies as they are encouraged in the development of metacognitive skills. Metacognition helps students evaluate their position and progress within a problem state (Collins, et. al., 1989). This awareness encourages students to examine their information need with greater depth and breadth, potentially creating better writing and better thinking (Flower & Hayes, 1980). As McGregor (1994) discovered students do not instinctively practice metacognition when they are attempting to use information more effectively. Incorporating group work is one way to encourage metacognition in students because students have to verbalize their thoughts and understandings for other group members in order to accomplish a task successfully (Pitts, 1995; Brown & Palincsar, 1989).

Current Understanding of Adolescent Information Use

Research indicates that along with topic-driven writing strategies, adolescents approach the research process with a strong orientation for product (McGregor, 1994); they tend to view the completion of the paper, not learning, thinking, or content, as the goal of research. McGregor (1984) found that adolescents who focus on product and reserve their actual information use activities until the construction of the paper are less likely than process-oriented students to engage in higher-order thinking. The other indicator of an adolescent's likelihood to engage in higher-order thinking in information use is the nature of the assignment; not surprisingly, assignments focused on analytical, rather than factual, questions were more prone to create higher-order thinking.

Building on Kuhlthau's principle of uncertainty in information seeking (Kuhlthau, 1993a), Pitts (1994; 1995) determined that adolescents have inadequately formed mental models of both information seeking and information use. Pitts found that students were unable to locate information to strengthen their subject understanding or to articulate their information needs in order to strengthen that understanding. Even if students hurdled those subject matter problems, they faced problems posed by an inadequate understanding of the information seeking and use systems. The students faltered because they lacked appropriate conceptual models to guide them in the information use process. In her study, the teachers and media specialists involved did little to facilitate improvement in the students' conceptual models; even when students asked for help, the adults never went further than providing locational advice. With an emphasis placed on physical access to information instead of intellectual access to information, students' products were poorly organized, often plagiarized, and showed little evidence of higher order thinking skills.

The ability of adolescents to effectively use information is further hampered by confusion both in establishing an information need as well as in determining the relevance of retrieved items in satisfying that need. Information need is not always directly related to the question being investigated (Liebscher & Marchionini, 1988) and so relevance is dynamic and is situated in the context of the current information need (Schamber, Eisenberg, & Nilan, 1990). Liebscher and Marchionini (1988) offer evidence that shows high school students who used more advanced search models were able to assimilate information from retrieved sources as reflected in the papers they wrote. Although their results were not conclusive, they indicate that students who were able to use higher order skills to define their information need during information seeking were successful in determining relevance as well. Similarly, McGregor (1994) found that if students are competent in employing a thoughtful search process, their ability to think about the information they find is enhanced.

Suggestions for testing and evaluating instructional strategies

One set of instructional strategies found in the literature of composition instruction which seems particularly suited to test under the cognitive apprenticeship model are teacher-led strategies which emphasize cognitive coaching and metacognitive development as well as allowing for scaffolded practice. Webbing, and related strategies including clustering, mazing, and concept mapping, is an example of one particular strategy in this set. It is a graphical representation of information in the form of nodes and links which is useful for refining information needs, planning a course of action, and illustrating relationships among information pieces (e.g. Vandergrift 1994; Bonds, 1989; Stripling & Pitts, 1988; Duthie, 1986). Strategy card instruction is a technique for procedural facilitation which provides a model of the reading, notetaking, and information use strategies so students can create cards which can serve them as prompts as they undertake these tasks (e.g. Higgins, 1993; Scardamalia & Bereiter, 1987). Another useful instructional strategy is teaching summarizing or paraphrasing which encourages students to move beyond direct copying of information and serves to enhance students comprehension of information. While these strategies may be introduced at the class level, they can be utilized in an instructional dialogue between a teacher and a single student, and the nature of these strategies allows opportunities for mediation at multiple points.

A similar set of student-led instructional strategies is also suggested by the literature on composition instruction. These strategies, which require some teacher set-up, emphasize the development of students' metacognitive skills and the social nature of learning. One of these strategies is reciprocal teaching, a cooperative technique in which students and teacher work in groups to question, clarify, summarize, and predict information items (e.g. Brown & Palincsar, 1989). A second strategy, peer conferencing or peer response is a hallmark of natural writing process instruction. Conferencing requires students to interact cooperatively to assess and evaluate one another's writing (e.g. Carney, 1996); students are given an environment to talk about their writing with peers. Because they create a shared responsibility for thinking as well as a shared body of expertise, conferences can assist students with evaluating evidence, determining a course of action, as well as identifying information needs (Brown & Palincsar, 1989). Finally, double-entry notetaking is a strategy which requires students to reflect or elaborate on the notes they take in a more personal way (e.g. Wroblewski, 1985); it may be useful for helping students evaluate and integrate evidence.

Since cognitive apprenticeship emphasizes the need for ongoing assessment, the assessment of the effectiveness of these instructional strategies utilized must also be ongoing. The effects of these strategies must be measured both in terms of students' achievement as well as their advancement in information use. Evaluators must look to see if students are more consistently providing support for conclusions, using analogies, evaluating evidence (often to avoid fallacies), planning a course of action, restructuring problems, seeking patterns, and incorporating anomalous data into a coherent framework (Halpern, 1993). Additionally, we propose that improved information use should lead students to achieve a greater frequency and accuracy in identifying their information needs, a greater use of evidence in supporting arguments, and a more logical organization of arguments in both written and oral formats. These assessments can be carried out through informal observation in class, pre-test/post-test for writing and speech characteristics, holistic evaluation of writing. More formal techniques traditionally utilized in discourse analysis such as clausal and t-unit assessment may be useful for providing a quantitative appraisal of complexity and structure.

Expected benefits of this research

McGregor (1994) points out the both teachers and school media specialists have as one of their central goals the enrichment and extension of students' thinking skills, however, while teachers typically emphasize thinking about information, school media specialists emphasize thinking that is external to information. Judging from the anecdotal evidence as well as the evidence coming from studies such as the *National Center for Education Statistics NAEP 1992 Writing Report Card* (Applebee, et. al., 1992), this division of labor and effort is not serving students well. Cognitive apprenticeship calls for a re-divisioned application of labor and effort, in which boundaries between teachers and media specialists become more fluid.

Because cognitive apprenticeship requires teachers and media specialists to blur the boundaries of their traditional roles, both groups must be concerned about thinking about information in all its forms, internal and external. The traditional roles of elementary and middle school teachers and media specialists are less amenable to the type of instruction we are proposing; by the college level, the roles of instructors and librarians have become so independent of one another that cooperation of this kind would be difficult for a number of reasons, both instructional and logistical. At the high school level, though, information use assignments such as research papers are curricular staples and partnerships between teachers and media specialists to create information use environments for students are more readily developed. It is at the high school level, then, that the role interaction between teachers and media specialist which cognitive apprenticeship of information use requires can be best cultivated; these groups can work to enhance those aspects of their professional abilities which can become interchangeable.

Similarly, the importance of focusing the cognitive apprenticeship model of information use on high school students is not a matter of convenience; rather it is our opportunity to target a user group which is at a formative level of development. Research on intellectual development has long seen adolescence as a time when people are beginning to develop the ability to think abstractly. As a consequence, adolescence is a fertile time to encourage the development of higher order thinking skills such as analysis, synthesis, and evaluation which are inherent in information use. It is important , then, for members of the library and information science community to begin working to create a better understanding of how we might foster this growth.

Research applying cognitive apprenticeship and its associated instructional strategies is one way to begin to develop this understanding. Because cognitive apprenticeship is directed at fostering a rich social and cognitive environment in which instruction occurs, the complex transformation of data into information into evidence in students' works can be acknowledged, discussed, and facilitated as can the transformation of evidence into argument though linking, countering, valuing, and critiquing. If the overarching goal of instruction in information use within a classroom setting is to move students towards expertise in cognitive activities (Paris & Winograd, 1990), then ignoring these transformations will not move students closer to that goal.

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Part Four

Information Literacy Assessment

Assessment Methods: On Beyond Craver
A Continuing Project

Blanche Woolls

Abstract

Teaching critical thinking skills through an information literacy program establishes the role of librarians as leaders in their schools. This paper defines critical thinking, reviews current literature and lists elements of critical thinking. How to teach critical thinking is discussed as well as ways to recognize critical thinking when it occurs and how to measure critical thinking in students.

Introduction

Treasure Mountain VI (TM6) is designed to discuss theories and strategies that would help improve the quality of information use by students and teachers and focuses on interventions to move the student to a more meaningful experience "in the analysis, synthesis, and application of information." As this paper was being prepared, it became apparent that the charge needed to be expanded. For most of our recent professional lives, we have used the research paper as our primary means of teaching information literacy and translated this into teaching critical thinking.

Information literacy requires the use of critical thinking skills, but the role of the media specialist in teaching critical thinking skills moves to a much broader definition. Information literacy, a major component, if not the core of critical thinking remains central to the mission of the school library. Some elements of critical thinking specifically relate to information literacy such as analyze, verify, problem solve, infer, transfer, sound evidence, and synthesize. The figure below illustrates the relationship of information literacy to critical thinking and charts a path for the media specialist to assume major responsibility for improving student critical thinking.

Figure 1
Elements of Critical Thinking

BELIEVE

digesting	observation	experience	decision-making	questioning
techniques	thinking	reasoning	transfering	meta-cognition
challenging	infering	**Information**	**Literacy**	sound evidence
reflecting	analyzing	conceptualizing	substantiating	reasoning
solving	verifying	problem solving	thinking	synthesizing
scripting	editing	applying	creating	presenting

DO

The final questions asked by TM6, "Can traditional methods of learning assessment be applied in nontraditional learning environments (interactive learning, constructivist learning)?" "Must we create new learning assessment models?" and "What assessment methods provide adequate measurement of higher order thinking skills?" seem especially important questions. Being able to assess when students have a more meaningful experience in the analysis, synthesis, and application of information, and, consequently, improve their higher order thinking skills would establish a vital role for library media specialists as they collaborate with teachers, but this assessment moves into the curriculum throughout the school. Our involvement permeates the curriculum across grades and subjects, and this participation is constant rather than during intervals when teachers bring students to the media center to conduct research.

One of the organizers of TM6 posed an answer to the first question, "Can traditional methods of learning assessment be applied in nontraditional learning environments (interactive learning, constructivist learning)?:"

> New methods of evaluation should be explored because students may be judged on questioning techniques, search and location strategies, listening skills, organization skills, scripting and editing skills, and presentation methods. . . Foundation, framework, and finished product each have need for new appraisal instruments and collaborative appraisers who have an inquiring method orientation.[1]

While creating new methods to assess how well introducing information to students could improve their thinking skills may be an irresistible challenge, assessment of critical thinking means assessing what is being taught throughout the school. Discussion of the relationship of media center activities to critical thinking skills was included in the first Treasure Mountain retreat. Craver ended her TM1 paper with

> As new information technologies are substituted for previous industrial operations, many workers ... will be forced to leave manufacturing and enter the "thinking business." Such a society will require individuals with the ability to think, to reason, to solve problems, to analyze, to make comparisons, to generalize, to digest existing information, and to create new information. Library science researchers will need to know how to improve the ability of students to find, synthesize, and correctly apply information to everyday situations.[2]

King[3] placed critical thinking needs into more personal terms directly applicable to the lives of students after they have completed basic education:

> ... which career to pursue, how to use their leisure time, which consumer products to purchase, what political causes and candidates to support, how to manage their financial resources, and what to do in their personal relationships...[4]

She predicted that "distinctions will become increasingly blurred between fact and opinion, between theory and belief, between what is real and what is simulated."[5]

Media specialists move beyond "know how to improve the ability of students to find, synthesize, and correctly apply information to everyday situations." Rather media specialists understand how to plan instruction, working closely and constantly with teachers. Together they ensure that students become critical thinkers. After these students have completed their basic education, they will make better decisions about "which career to pursue, how to use their leisure time, which consumer products to purchase, what political causes and candidates to support, how to manage their financial resources, and

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[1] D. Callison, "Expanding the Evaluation Role in the Critical Thinking Curriculum," in *School Library Media Annual, 1993*. (Englewood, CO: Libraries Unlimited, 1993), pp. 78-92.

[2] K.W. Craver, "Critical Thinking: Implications for Library Research," in *The Research of School Library Media Centers: Papers of the Treasure Mountain Research Retreat, Park City, Utah, October 17-18, 1989*, edited by B. Woolls (Castle Rock, CO: Hi Willow Research and Publishing, 1990). pp. 129-30.

[3] A. King, "Inquiry as a Tool in Critical Thinking," in Halpern, *Changing College Classrooms: New Teaching and Learning Strategies for an Increasingly Complex World."* (San Francisco, CA: Jossey-Bass Publishers, 1994). p. 13.

[4] *Ibid.*

[5] *Ibid.*

what to do in their personal relationships." Our goal becomes "to ensure that our students can decide..." and to do that we must participate fully in the teaching and learning process, helping teachers engage students in their education so they exercise reasonable reflective thinking and believe and do. To support this premise, this paper will:

define critical thinking,
review current research literature on critical thinking,
list the elements of critical thinking,
discuss how to teach critical thinking skills,
describe how to recognize critical thinking when it occurs, and
show how to measure critical thinking in students.

While this author planned to concentrate on measurement, it grows into a discussion of the elements of critical thinking, teaching and recognizing critical thinking, and convincing teachers to collaborate before planning what to measure.

Definitions of Critical Thinking

Definitions of critical thinking by educators point out the need for expanded efforts from media specialists. The definition provided by Paul places critical thinking into a process that requires students' personal attention to gathering information from a variety of sources both inside and outside the media center and moving students away from accepting, without question, what they are told by another:

> Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.[1]

He goes on to discuss clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

King thinks that "The hallmark of a critical thinker is an inquiring mind,"[2] and that "good thinkers were good questioners."[3] She repeats many of Paul's descriptors adding *inferring, comparison-contrast, verifying, substantiating, explanation, and hypothesizing* to the list.[4]

While Ennis[5] does not believe that critical thinking and higher order thinking skills are synonymous because, "...that idea is so vague,"[6] he agrees that "...critical thinking, a practical activity, includes most or all of the directly practical higher order thinking skills." He considers critical thinking as reasonable reflective thinking, and restates "belief and action" as "believe or do."[7]

Gibson[8] suggests that, while critical thinking is often joined with similar concepts such as problem solving, decision making, reasoning, and informal logic, they are, in reality, different. It is active learning such as collaborative learning and problem-based learning that leads to the development of critical thinking abilities.

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[1] M. Scriven and R. Paul, *Goals of the National Council for Excellence in Critical Thinking Instruction*, (Santa Rosa, CA: Foundation for Critical Thinking, 1991).
[2] King, *op. cit.*, p. 17.
[3] *Ibid.*, p. 18.
[4] *Ibid.*, p. 19.
[5] R.H. Ennis, "A Taxonomy of Critical Thinking Dispositions and Abilities," in J.B. Baron and R.J. Sternberg, eds. *Teaching Thinking Skills: Theory and Practice," (New York: W.H. Freeman and Company, 1987).*
[6] *Ibid.*, p. 10.
[7] *Ibid.*
[8] C. Gibson, "Critical Thinking: Implications for Instruction," *RQ* 35: 27-35 (Fall, 1995).

What critical thinking is intended to achieve is

> ...an understanding of the relationship of language to logic, leading to the ability to analyze, criticize, and advocate ideas, to reason inductively and deductively, and to reach factual and judgmental conclusions based on sound inferences drawn from unambiguous statements of knowledge or belief.[1]

Quellmalz's[2] definition of higher-order thinking is that

> Students engage in purposeful, extended lines of thought during which they:
> Identify the task or problem type.
> Define and clarify essential elements and terms.
> Judge and connect relevant information.
> Evaluate the adequacy of information and procedures for drawing conclusions and of solving problems.

Defining critical thinking skills and their nebulous, unidentifiable nature has been a major problem in trying to both teach and assess the progress of students toward achieving higher levels of skills. If our role is to help students reflect before making decisions about what to believe or do, our evaluation measures need to determine if students are able to make such decisions using their critical thinking skills. We will also need to test students' ability to use reflective thinking to conceptualize, apply, analyze, synthesize, evaluate, use observations and experiences, reflect, reason, and communicate as well as infer, compare/contrast, verify, substantiate, explain, and hypothesize, and ultimately whether they think about what they "believe and do." Students accomplish many of these in a research paper in expanding their information literacy competencies, but these skills must move into daily curriculum assignments in all classrooms.

To Review Current Research Literature

A literature search made to find research reports about assessing critical thinking published in the years since the first Treasure Mountain was not too successful. Little new research exists, and most published articles are in the how-to-do-it category rather than evidence that thinking skills are being addressed, how or if any improvement has been determined, or what degree of change has been measured. The latest research has more often been conducted in the academic library field.

In one study, undergraduates were assigned to one of 12 treatment groups. Tierney assessed the effects of reading and writing upon thinking critically and found that

> reading and writing in combination contributed to a wide range of revisions (additions, deletions, substitutions, etc.) and to higher quality drafts (especially in content) than writing alone.[3]

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1 R.W. Paul, *Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World.* (Sonoma State University, Rohnert Park, CA: Center for Critical Thinking, 1992), p. 1.

2 E.S. Quellmalz, "Needed: Better Methods for Testing Higher-Order Thinking Skills," *Educational Leadership*, 43: 29-35 (October 1985), p. 30.

3 R.J. Tierney, *et. al.*, "The Effects of Reading and Writing Upon Thinking Critically." *Reading Research Quarterly* 24:134-173 (Spring 1989).
3

Further, students who read and wrote also engaged in thinking that was dialectical in nature.

> Writing served as the mode through which the learner allowed ideas to come to fruition and resolved disputes. Reading served as a resource for opposing views or for further elaborations upon an idea.[1]

A qualitative study of higher-order thinking skills conducted by McGregor explored the "relationship between thinking, information use, and the research paper as a vehicle for teaching thinking skills."[2] She examined her findings in the framework of a Search Phase based on Kuhlthau's six Information Search Process stages.

Focusing on reflective thinking and self-reflection and the effect upon student growth, Seiter[3] observed the influence of portfolios on higher order thinking skills. Testing a student's analysis, synthesis and evaluation in a social studies class matched to a lecture only classroom, he determined that portfolios did not have much effect in increasing higher order thinking skills. Because no basic skills test was available, he recommended that such be developed. His second suggestion, a larger scale study of teaching and assessing for content using portfolios, he felt would be difficult. "The different teaching techniques might, however, be an insurmountable barrier."[4]

Researchers[5] tested the spontaneous transfer of thinking skills to real-world problems by telephoning students at home several months after they were out of school. Saying they were taking a sports poll, graduates in their study were asked to comment on sports figures using critical questions that required their use of concepts such as regression to the mean and appropriate sample size. The evaluators considered that students had both learned how to and were continuing to use their thinking skills.

It appears that the literature lacks good assessment models to provide adequate measures of higher order thinking skills. If we are to create new learning assessment models beyond information literacy and beyond research assignments, we must understand the elements of critical thinking.

To List the Elements of Critical Thinking

The review of the literature provided elements that should be in place before critical thinking can be taught and which are found in critical thinking and teaching of critical thinking skills. The school environment and educator attitudes set the stage for teaching critical thinking.

Six factors that Ennis[6] believes are essential to teaching critical thinking skills are teachers with time to explore new teaching ideas, materials, sympathetic administrators, pilot curricula, evaluating and disseminating efforts. Media specialists have little control over division of teachers' time to explore. In fact, when a media center schedule lacks flexibility, the media specialist misses that exploration process altogether. Because it is central to critical thinking, administrators need to be convinced of the value of collaboration and team planning for critical thinking.

Media specialists who plan in-service sessions for teachers introduce new teaching ideas and ask for suggestions in selection of materials. They aid in developing pilot curricula. Active participation in planning means active participation in evaluating and disseminating both successful and unsuccessful

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1 *Ibid.*

2 J.H. McGregor, "Cognitive Processes and the Use of Information: A Qualitative Study of Higher-Order Thinking Skills Used in the Research Process by Students in a Gifted Program," *School Library Media Annual 1994*. (Englewood, CO: 1994), p. 124-133.

3 D.M. Seiter. "Assessing the Influence of Portfolios on Higher Order Thinking Skills." Weber State University, 1995. (ED 391737).

4 *Ibid.*

5 .D. Lehman and R. Nisbett. "A Longitudinal Study of the Effects of Undergraduate Training on Reasoning," *Developmental Psychologist* 26: 952-60 (1990).

6 Ennis, *op cit.* p. 15-16.

efforts. Ennis recommends "careful, continual *evaluation*[1]," as a requirement for testing critical thinking skills. Media specialists, because they work with students during the entire time they are in the school, understand learning needs and solutions and can better recognize improvements longitudinally.

King points out that teachers must adopt a "disposition for thinking."[2] Callison suggests that "Students need access to models and examples" so they can "visualize possibilities, critically examine products that have preceded their assignment," and be challenged to do a better job at the task. When media specialists and teachers understand and model the thinking process, students are more likely to engage in critical thinking. Therefore, one element includes the degree to which students see others, teachers and peers, thinking critically.

Philosophic constructs are found in concepts from the cognitive domain of Bloom's *Taxonomy.*

> Objectives which emphasize remembering or reproducing something which has presumably been learned, as well as objectives which involve the solving of some intellective task for which the individual has to determine the essential problem and then reorder given material or combine it with ideas, methods, or procedures previously learned. Cognitive objectives vary from simple recall of material learned to highly original and creative ways of combining and synthesizing new ideas and materials.[3]

Crane and Markowitz[4] used Bloom's *Taxonomy* and combined technology with developing critical thinking skills. Experiences with assignments involving the use of technology can require students to "focus, narrow, and pursue their topics, and reflect on their own thinking processes."[5]

Brookfield[6] describes critical thinkers as persons who "see themselves as creating and re-creating aspects of their personal lives."[7] Other attributes include an appreciation of creativity, innovators, life as full of possibilities, self-confident, and aware of diversity of values, behavior, and social structure. Critical thinking is not an outcome but a process.

According to Brookfield, manifestations vary. Some are internal and others are external. Internal manifestations can be traced in writing and talking while external are shown with persons who depart from habit. Media specialists who observe students over time recognize their departure from habit.

Brookfield believes that critical thinking can be triggered by both positive and negative events, is emotive as well as rational. Emotions remain important to critical thinking. His components of critical thinking can be observed when students

> Identify and challenge assumptions,
> Challenge the importance of context, but are contextually aware,
> Imagine and explore alternatives, and
> Imagine and explore alternatives leading to reflective skepticism.[8]

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[1] *Ibid.*

[2] King, *op. cit.*, p. 20.

[3] D.R. Krathwohl, B.S. Bloom, and B.B. Masia, *Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook II: Affective Domain* (New York: David McKay, 1964), p. 6.

[4] B. Crane and N.L. Markowitz, "A Model for Teaching Critical Thinking Through Online Searching," 7: 41-52 *The Reference Librarian* (1944).

[5] *Ibid.*, p. 51.

[6] Stephen D. Brookfield. *Developing Critical Thinkers: Challenging Adults to Explore Alternative Ways of Thinking and Acting.* (San Francisco: Jossey-Bass, 1989).

[7] *Ibid., p. 5.*

[8] *Ibid.*, p. 8-9.

Time is an element in the critical thinking process. Students need time to think through alternative solutions. More, not less time is needed if instruction programs in media centers are to succeed. Baron[1] asks, "Is the time allowed sufficient for the students to attain the skills? Do the classroom and school environment support the skills and dispositions sought?"

Gibson says that "The short-tool oriented approach merely reinforces dependency because it does not seek to promote students' understanding of research questions, information systems, and their own information-seeking abilities and patterns."[2] He is confident that the use of OPACs and CD-ROM will not automatically help students exercise their critical thinking skills.

When teachers lecture and students memorize and repeat, we should question whether students acquire knowledge. Paul suggests that this is one of many "uncritically held assumptions that need to be explicitly and unequivocally refuted." Others to be refuted include:

- that students learn *how* to think when they know *what* to think,
- that knowledge can be given directly to students without their having to think it through for themselves,
- that the process of education is, in essence, the process of storing content in the head like data in a computer,
- that quiet classes with little student talk are evidence of student learning,
- that students gain significant knowledge without seeking or valuing it,
- that material should be presented from the point of view of the one who knows,
- that superficial learning can later be deepened,
- that coverage is more important than depth,
- that students who correctly answer questions, provide definitions, and supply formulae demonstrate substantial understanding, and
- that students learn best by working alone.[3]

Rather he suggests the following:

- that students learn *what* to think only as they learn *how* to think,
- that one gains knowledge *only* through thinking,
- that the process of education is the process of each student gathering, analyzing, synthesizing, applying, and assessing information for him or herself,
- that classes with much student talk, focused on live issues, is a better sign of learning than quiet classes focused on a passive acceptance of what the teacher says.
- that students gain significant knowledge only when they value it,
- that information should be presented so as to be understandable from the point of view of the learner, hence continually related to the learner's experiences and point of view,
- that superficial learning is often mis-learning and stands as an obstacle to deeper understanding,
- that depth is more important than coverage,
- that students can often provide correct answers, repeat definitions, and apply formulas while not understanding those answers, definitions, or formulas, and
- that students learn best by working together with other students, actively debating and exchanging ideas.[4]

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[1] J.B. Baron, "Evaluating Thinking Skills in the Classroom," in *Teaching Thinking Skills: Theory and Practice*, edited by J.B. Baron and R.J. Sternberg (New York: W.H. Freeman and Company, 1987): p. 236.

[2] Gibson, *op. cit.*, p. 31.

[3] *Ibid.*

[4] *C. Gibson, "Alternatives to the Term Paper: An Aid to Critical Thinking," in Integrating Library Use Skills into the General Education Curriculum*, edited by M. Pastin and B. Katz (New York: Haworth Press, 1989), p. 297.

To reinforce Paul's final point, the media center becomes the logical place to create a learning environment that allows students to work alone and in groups, to apply what they learn, and to assess their own learning as well as to have it assessed by the teacher and media specialist. Because the media center is not tied to a single grade or subject area, more opportunities for transfer of learning are provided.

MacAdam expands the communication aspect of critical thinking. "The role of language--whether speaking, reading, or writing--may be virtually inseparable from the development of higher order reasoning ability."[1] Her elements of critical thinking include

Active participants rather than passive recipients
Self direction and individual motivation
Conceptual frameworks in organizing knowledge and the role of prior knowledge
Abstract thinking to extrapolate from experience to ideas or conclusions.

Some researchers consider listening skills as an outcome of critical thinking and something to be measured. However, listening skills as well as a good background knowledge are elements that must be in place if students are going to be able to exercise critical thinking. Because concepts should build upon prior knowledge, learning and relearning out of context require more time and are less likely to cause transfer of learning.

Elements of critical thinking include other measures such as metacognition, the awareness and control of one's own thinking. Metacognition is observed when students learn to take note of what they have trouble learning, checking facts before accepting them, looking carefully at each item in a multiple choice test before answering. Helping teachers analyze log books that show the students' problem solving strategies also confirm metacognition.

Perhaps the most difficult aspect of metacognition will be allowing students time to think about what they are thinking. Some students are able to observe and reflect but not necessarily synthesize what they have learned unless they have time. That process is less likely to occur when a rigid schedule limits student access to information in the media center. This becomes another argument for flexible scheduling to provide open access for block schedules and assignments that may extend over an entire semester.

One of the most important elements in teaching critical thinking is the transfer of thinking from a narrow perspective to a much wider one. Media specialists who lead in curriculum reform help teachers collaborate and teach a theme rather than dictate words of wisdom about a singular topic in a designated subject area to one grade level of students or, worse still, assign pages of reading in a textbook and ask students to answer the questions at the end of the chapter.

To Teach Critical Thinking Skills

Some educators debate whether you can teach critical thinking skills or whether they are innate characteristics of some students and not others. In order to bypass this, teaching also means "to provide opportunities to exercise" critical thinking. The emphasis is on those skills which involve the media center.

1. Students must have access to resources.

An assumption is made that to teach critical thinking skills, the media specialist, teachers, and students should have access to an adequate collection of resources. Further, class assignments should anticipate

[1] B. MacAdam, "Sustaining the Culture of the book: The Role of Enrichment Reading and Critical Thinking in the Undergraduate Curriculum," *Library Trends* 44:237 (Fall 1995).

the use of those resources. The size of the resource collection as a criterion for successful critical thinking should be studied.

Teaching critical thinking skills successfully would imply that teachers and media specialist understand how these skills are taught. Students must move from what they know and have experienced into new experiences while they use their critical thinking skills to create new learning for themselves, and sometimes for their peers. Spicer suggests a first "test" is finding out what students know as a part of a two-step approach to teaching. "First, decide what students should be able to demonstrate and what they know and can do. Second, decide what to teach students."[1] This strategy helps the team of teachers and media specialist understand the intended performance and the anticipated results, providing a set of criteria for assessment as well as setting the priorities for student learning.

2. Begin with elementary teachers teaching the basics.

Resnick's[2] process for teaching thinking skills incorporate the traditional curriculum that allows students to learn and think across many fields: reading, writing, the skills for effective oral communication, and mathematics. She adds "reasoning" to this list. Critical thinking skills can and should be taught at an early age.

Teaching critical thinking to very young children may include the use of icons, a basic understanding for computer searches. When media specialists share picture books, they can move into analyzing fact and fiction.

> Teaching children to recognize and read the language of picture books therefore introduces them to a significant and strategic process, preparing them to interpret the wider world of iconic information that characterizes the information age ... News and information can be distorted and constructed to represent a slanted point of view. Children's picture books that play with this theme can be useful tools to develop critical viewing and thinking skills as children experiment with familiar tales through new perspectives. Examining several versions of the same story can also help children see the way very different authors and artists interpret and represent the same story. This concept can be easily applied to the way different newspapers and networks cover the same story.[3]

3. Employ the question/answer process.

King[4] believes in "orchestrating" learning through the motivation of students, posing thought-provoking questions so that students can carefully compose their own answers rather than make an unconsidered response. Sorting questions into logical patterns activates the thinking process.

4. Teach the research process as a thinking skills process.

Media specialists traditionally teach research to prepare a written report with emphasis on the search process rather than hypothesis forming. Teaching research skills must be turned into a thinking process. Swim wants the research process to become a life-long thinking skill:

> Instead of a dull and boring activity in which a student hurries through an unexciting assignments, ... library research can be a project which engages the student in a thoughtful quest using skills that will serve him/her for a lifetime of solving everyday problems.[5]

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[1] K.L. Spicer and W.E. Hanks, "Multiple Measures of Critical Thinking Skills and Predisposition in Assessment of Critical Thinking." (ED 391185), p. 7.

[2] L.B. Resnick, *Education and Learning to Think* (Washington, D.C.: National Academy Press, 1987), p. 37.

[3] D.M. Considine, G.E. Haley, and L.E. Lacy, *Imagine That: Developing Critical Thinking and Critical Viewing Through Children's Literature.* (Englewood, CO: Teacher's Ideas Press, 1994).

[4] King, *op. cit.*, p. 17.

[5] P. Swim, "Teaching Critical Thinking Through Library Research," *Indiana Media Journal* 16: 63-70 (Fall 1993).

Callison[1] echoes Kulthau in suggesting that students must learn to brainstorm, explore the literature, raise questions, and discuss potential topics before they begin their search for information. Gibson[2] proposes some suggestions for research assignments to help students engage in critical thinking. Students are challenged to use resources critically on a significant contemporary issue, analyzing and evaluating varying perspectives, considering how academic disciplines differ in treating an issue, real life case studies, and pathfinders.

5. Use bibliographic instruction to begin critical thinking.

One academic librarian[3] suggests that it is now time to focus bibliographic instruction on what students need to know rather than what academic librarians wish to teach them, a lesson learned earlier by media specialists but one which a rigid schedule and the research paper as an end in itself have hampered any improvement in when and why bibliographic skills are introduced.

Abstract thinking to extrapolate from experience to ideas or conclusions is explained by MacAdam.[4] Her mechanism for making this happen occurs in bibliographic instruction which she believes "has emphasized the importance of curriculum integration and the incorporation of critical thinking in teaching."[5]

According to Wesley[6] the best use of the short time allocated to the media specialist for instruction, students should be taught to locate main issues and

> the relationships among related concerns. They can gain experience in determining the appropriate types of information sources--expert, general; primary, secondary; narrative, graphic; etc... They can understand that every piece of information comes from a specific frame of reference and represents truth only in that frame of reference. They can begin to feel comfortable questioning all sources of information they encounter. These competencies, not their knowledge of specific libraries or library tools, are the skills which will enable our students to be effective users of information.[7]

6. Allow time for thoughtful analysis.

Three authors agree with Gibson in an earlier report where he suggested that more not less time is needed, while acknowledging the reality of time allocated to teaching. The place of composition studies and their relationship to the library are described by Kautzman.[8] Yet, her proposal integrates critical thinking and library skills into a single one-hour session proposed for college research papers. This would seem insufficient for critical thinking to occur.

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[1] Callison, *op. cit.*

[2] Gibson, "Alternatives to the Term Paper," *op. cit.*, pp. 297-309.

[3] C. LaGuardia, "Renegade Library Instruction," *Library Journal* 117:51-53 (October 1, 1992).

[4] MacAdam, *op. cit.*, pp. 240-242.

[5] *Ibid.*, p. 237.

[6] T. Wesley, "Teaching Library Research: Are We Preparing Students for Effective Information Use?" *Emergency Librarian* 18:23-30 (January-February 1991).

[7] *Ibid.*, p. 24.

[8] A.M. Kautzman, "Teaching Critical Thinking: The Alliance of Composition Studies and Research Instruction," 61-65 *Teaching Critical Thinking* (Fall 1996).

7. Teach critical thinking as credibility and relevance of content.

Wesley is also concerned that students learn to plan so that they don't accept what they find as the true information. They need to experiment with the concept of *serendipity* as an "influential factor." Also, she encourages media specialists to teach students not to narrow the topic too early because students need to investigate the issue from several relationships between events and issues and perspectives on the topic.

Teaching in the media center expands use of resources into an explanation of the content of resources and making critical judgments of the relevance of resources. Previously the atlas lesson included understanding symbols in the atlas. This now requires some explanation of the history around boundary changes in countries. The math needed to interpret charts and graphs in periodicals confuses some students. Reading the information in a table in *World Almanac* expands beyond locating the numbers on the table into placing them in a wider context. Critical thinking begins when information in charts is questioned rather than accepted without question.

Teaching critical thinking skills in the media center environment helps students learn how to make relevant choices from the myriad of possibilities. Confusion increases when new technologies bring more and more resources into libraries. In an article directed at academic librarians, Oberman[1] likens the choices in the electronic environment to choices in cereal aisle(s) of large supermarkets. Problems of choice among items located in the media center escalate with each new CD-ROM or direct access database added and each Web site connection added to the Internet. The speed of surfing the Internet makes it seem easy to locate information. Helping students decide what is relevant, applicable, appropriate, and accurate will require analysis and retrospection and the use of well learned critical thinking skills.

8. Teach critical thinking as a lifelong use of the library.

Students who learn how to learn in their media center will become lifelong users of libraries as information centers. The students' ability to "believe and do" continues with their knowledge of the existence of libraries and their ability to see and use information.

To Recognize Critical Thinking When It Occurs

To assess critical thinking demands that media specialists recognize critical thinking when it is occurring. This means moving beyond what has often been considered as learning in process: enthusiasm, excitement, well behaved attention, answering questions, and busy. These do not necessarily guarantee that effective thinking is occurring.[2] Resnick[3] suggests the following as evidence of critical thinking:

> The path of action is not fully specified in advance.
> The total path is not 'visible' from any single vantage point.
> Multiple solutions with costs and benefits are provided rather than unique solutions.
> Nuanced judgment and interpretations are involved.
> Application of multiple criteria is in evidence, some in conflict with one another.
> Not everything bearing on the task at hand is known.

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1 C. Oberman, "Avoiding the Cereal Syndrome, or Critical Thinking in the Electronic Environment," *Library Trends* 39: 189-202 (Winter 1991).

2 Baron, *op. cit.*, p. 227.

3 Resnick, *op. cit.*, p. 3.

Students must self-regulate the thinking process rather than allow another to set the steps for the solution.

Students find meaning out of apparent disorder.
Higher order thinking requires considerable mental work.

In her discussion of the evidence that college students are being taught to improve how they think, Halpern[1] lists the following as examples of thinking skills and evidence that students are exercising critical thinking:

reading with a high level of comprehension
providing support for a conclusion
understanding principles of likelihood and uncertainty
using analogies
reasoning about ratios
recognizing the difference between correlation and cause
combinatorial reasoning
isolating and controlling variables
evaluating evidence (often with emphasis on avoiding fallacies)
planning a course of action
modeling
generating hypotheses
using retention (memory) strategies
making spatial representations
restructuring problems
using problem-solving heuristics
seeking patterns
incorporating anomalous data into a coherent framework
recognizing regression to the mean

To Measure Critical Thinking in Students

Planning for the assessment of critical thinking is, at best, difficult. Tests exist and we must decide if they meet our needs. Gardner's definition of assessment applies to judging the efforts of students to exercise their critical thinking skills:

> ...the obtaining of information about the skills and potentials of individuals, with the dual goals of providing useful feedback to the individuals and useful data to the surrounding community. What distinguishes assessment from testing is the former's favoring of techniques that elicit information in the course of ordinary performance and its general uneasiness with the use of formal instruments administered in a neutral, decontextualized setting.[2]

At the present time, several formal instruments to test critical thinking skills exist and these will be described later. They are placed in a category, commercial tests, because they must be ordered from an outside source.

Commercial tests. Methods are in place to assess the information search process and the products of these searches. Some are commercial and some have been developed by teachers. Some may have been influenced by a media specialist, but the degree of influence remains undocumented.

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[1] D.F. Halpern, "Assessing the Effectiveness of Critical Thinking Instruction," *JGE: The Journal of General Education* 42: 238-254 (1993).

[2] H. Gardner, *Multiple Intelligences: The Theory in Practice* (New York: BasicBooks, 1993), p. 174.

Ennis[1] lists ten tests covering more than one aspect of critical thinking and four tests that cover only a single aspect. This is an update of his earlier listings in Norris and Ennis.[2] Modjeski and Michael[3] evaluated the reliability and validity of two tests of critical thinking, the Cornell Critical Thinking Text, Level X and the Watson-Glaser Critical Thinking Appraisal, Form YM. Their recommendation was

> If the criteria provided by the *Standards* are appropriate to the evaluation of the two tests of critical thinking just considered, it would appear that a great deal of research and development effort needs to be expended to improve the reliability and validity of the Cornell and Watson-Glaser. It is recommended that consideration be given to revising both scales in the near future.[4]

According to Ennis' listing, the Cornell Critical Thinking Text was reissued in 1985 and the Watson-Glaser remains the same. The only test on the Ennis list published after 1989 is The California Critical Thinking Skills Test: College Level, published in 1990.

Spicer[5] lists seven tests, five of which are on the 1985 Ennis listing. The two new ones are "The California Critical Thinking Skills Test" and "The California Critical Thinking Dispositions Inventory." She notes that all of these tests share a basic weakness of "reducing critical thinking to a set of responses," and argues for "use of multiple measures of critical thinking, including open-ended performance measures."[6] Norris and Ennis have suggested criteria to apply to commercial tests being considered for purchase. Helping choose an appropriate test places media specialists in the teaching role and helps others with less experience in evaluating tests. The criteria could also be applied to any tests that might be developed in the school.

> Pay close attention to the directions, the items, and the scoring guide.
> Take the test yourself, and compare your answers with those of the guide.
> Satisfy yourself that the scoring guide is reasonable, but do not expect to agree with it completely for any but deduction items.
> Ask yourself often, "Does this really test for some aspect of critical thinking?"
> For purported comprehensive critical thinking tests, ask yourself, "Does this cover enough of critical thinking in a balanced manner to be called a comprehensive critical thinking test?"
> For purported aspect-specific critical thinking tests, ask yourself, "Does this cover enough of the aspect?"
> Read the test manual and not the statistical information, but remember the test publishers have a conflict of interest in deciding what information to include and exclude, and remember our warnings about information on reliability.[7]

Creating your own tests: Developing tests is never easy. School districts are willing to pay large sums to buy standardized tests. Perhaps our reluctance to be evaluated makes us reluctant to evaluate. The uncertainty of the quality of any self-designed test to measure what it intends to measure is paramount and few media specialists have the skill, the time to test and retest, and the appropriate test group(s) to confirm findings.

For media specialists to lead in assessment, they must accept responsibility for creating and helping to create tests. Although little evidence exists, we can begin by building on evaluation already begun. For instance, one program for advancing critical thinking in an Earth Science Geography course was

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1 R.H. Ennis, "Critical Thinking Assessment," *Theory into Practice* 32: 179-186 (Summer 1993).

2 S.P. Norris and R.H. Ennis, *Evaluating Critical Thinking* (Pacific Grove, CA: Midwest Publications Critical Thinking Press, 1989.)

3 R.B. Modjeski and W.B. Michael, "An Evaluation by a Panel of Psychologists of the Reliability and Validity of Two Tests of Critical Thinking," *Educational and Psychological Measurement* 43: 1187-1197 (1983).

4 *Ibid.*, p. 1196.

5 Spicer, *op. cit.*

6 *Ibid.*, p. 6.

7 S.P. Norris and R.H. Ennis, *The Practitioners' Guide to Teaching Thinking Series: Evaluating Critical Thinking*, (Pacific Grove, CA: Midwest Publications Critical Thinking Press, 1989), p. 56.

developed by Fraker[1] for high school freshmen. Evaluation was conducted through a teacher check list of critical thinking skills matched to each assignment and pre- and post-tests. Such evaluation has not been given rigorous testing. Since we cannot rely on these, we must return to the theory of testing to help us build our own.

Some general directions are suggested. The first step is to decide what will be measured, the criteria.

1. Formulate criteria.

Create criteria for judging that are developed by more than one person. Media specialists lead groups of teachers working with students and parents in this process. Baron[2] suggests that having students help design criteria allows them to compare their conceptions with other students and the teacher. Further, they will be clear about goals, have ownership, can monitor their own progress, can learn to apply this to the real-life situation as well as have more accurate, less impressionistic measures.

While there are no students at this Treasure Mountain retreat, we teacher/media specialists can work on criteria. To ensure that critical thinking has been taught, Ennis has thirteen dispositions essential for the critical thinker. His four basic areas are *clarity, basis, inference,* and *interaction*. These are matched to activities requiring and, we hope, improving student thinking skills. This author's attempt to apply Ennis' dispositions in the context of the research paper assignment and an increasing level of thinking skills is given in Appendix A. Since we do not know how well this would measure thinking skills and if the three levels are appropriate, the subtitle of the paper is "A Continuing Project."

Classroom teachers and media specialists together look for "side effects" such as improved attendance in school, more frequent use of the media center because curiosity has been stimulated. A final outcome is that all involved in the process have more respect for each other.

Paul and Nosich, in their *Model for the National Assessment of Higher Order Thinking*,[3] describe twenty-one criteria (See Appendix B.) for higher order thinking assessment in four domains of critical thinking, and they provide test strategies that may be used to test higher order thinking. These criteria might seem difficult or overwhelming for most teachers and media specialists who are just beginning to plan assessment processes; yet individual criteria can be applied to the assessment of projects in schools.

Brookfield's criteria (See Appendix B.) include recognizing when students have identified and challenged assumptions and recognizing when students have contextual awareness. In establishing criteria, Quellmalz[4] specified the skills needed before designing tasks and then decided how to judge achievement. Skills specified should be common to several conceptualizations and applied in academic, real life, and novel tasks. A manageable number of skills are selected and placed in a coherent framework. In designing tasks, he suggested identifying significant, recurring problem types; assessing integrated skills, not just components; including tasks that permit alternative interpretations or solutions, designing open formats that ask for explanations of reasoning, and building sets of tasks that represent a desired range of generalization and transfer.[5]

[1] D.M. Fraker, "Improving High Student Critical Thinking Skills," 1995 Szvier University (ED 391725).

[2] Baron, *op. cit.*, p. 225.

[3] R. Paul and G.M. Nosich, "A Model for the National Assessment of Higher Order Thinking," ED 353 296 (Santa Rosa, CA, Foundation for Critical Thinking, 1992).

[4] E.S. Quellmalz. "Needed: Better Methods for Testing Higher-Order Thinking Skills." *Educational Leadership* 43:28-35 (October 1985).

[5] Quellmalz, *Ibid.*, p. 32.

2. Look for sustained effects and not immediate recall.

Callison[1] suggests that standards be set at various checkpoints in the process to determine if students are making satisfactory progress. While students may be less able to define a level of achievement, teachers and media specialists place achievement on a scale and then review the standards to see if expectations are too low, too high, or correct. The point here is that assessment goes beyond a first or single test to analyzing over time the students' continued and expanded use of critical thinking skills.

Baron[2] agrees that evaluation should occur over an extended period of time and suggests that your purpose for conducting an evaluation should determine the type of evaluation. Her four evaluation types from which to choose: formative-summative, product-process, qualitative-quantitative, and experimental-quasi-experimental designs. These are expanded in Appendix C.

In looking for sustained effects, students are monitored as they move from grade to grade. The media specialist who serves all the students for their life in the school tracks students for teachers as students move from level to level. Because media specialists work with all teachers, all students, and all the curriculum all the time, they are able to point out transfer of learning when it occurs.

3. Look for transfer.

Analyze when students begin to relate information from one subject to another, when they question a television commercial's "truth" by something learned in science or health. Placing a novel in its historical period before having this pointed out by the teacher shows transfer. This is a much hoped for outcome of efforts to teach critical thinking. Evaluation of transfer has eluded researchers and presents a formidable challenge.

4. Use a variety of approaches.

We understand that students may respond differently to different types of measurement. Students may be very creative thinkers and provide interesting thoughts to class discussion but be unable to write their thoughts. On the opposite end of the scale, a student may be able to write very well but be too shy to speak to the class. A checklist of discussion criteria will be found in Appendix D.

Suggestions for developing specific types of assessment and their application for media specialists include multiple-choice, self-assessment, performance measures checklists, interviews, student and teacher logs with writing to evaluate thinking, quality of resources chosen, and portfolios. Callison has added questioning techniques, search and location strategies, listening skills, organization skills, and scripting and editing skills.[3]

Multiple-Choice Tests: Norris and Ennis,[4] suggest the following for creating multiple-choice tests and open-ended information gathering techniques to assess critical thinking skills. Their advice for multiple choice

> Use the comparative-judgment approach for credibility, induction, and assumption-identification items.
> Use the noncomparative-judgment approach for deduction items.
> Provide as much context as is permitted by the reading load.
> Interview examinees who are like the target examinees in order to see what sorts of background beliefs and levels of sophistication they bring to the items.

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1 Callison, *op. cit.*, p. 53.

2 Baron, *op. cit.*,pp. 221-247.

3 Callison, *op. cit.*, p. 54.

4 Ennis and Norris, "Critical Thinking Assessment," *op. cit.*

Add an item that offers possible justifications for the options in the original item, but be aware that you might be giving examinees ideas they would not otherwise have.
Add an open-ended request to examinees to explain why they answered as they did.
Be well informed about critical thinking and the topic of the item, whether it be general knowledge or some specific school subject.
Beware of the different threads of meaning associated with the term, "assumption\": conclusions, pejorative force, and basis. Arrange things so that you are really testing for the basic type of assumptions.

In devising open-ended approaches, seven guidelines should be followed:

Pilot your evaluation with a sample of students to make sure that it provides an interesting context as the basis of the reasoning task.
In your pilot test, try to be sure that students understand the task or the questions in the way intended.
As part of your task, seek justification from students for what they say and write.
Be generous in interpreting students' responses.
When grading students' responses, distinguish the truth of what they say from its relevance to the task as you described it.
Look for patterns of strengths and weaknesses within individual student's responses and in responses from all students.
Try to infer the presence and absence of critical thinking dispositions from what students say or write and from what they do not say or write, and make notes on your inferences and the evidence for them.

Killoran[1] defends the multiple-choice question for performance testing. His suggestions for developing multiple-choice questions are divided into both formats: standard multiple choice and database questions. His standard groups include several basic types: recognition of important terms and persons, compare and contrast, cause and effect, generalizations, chronology, and special types. For the development of database questions he includes comprehensive questions, explanatory questions, conclusion or generalization questions, and prediction questions.

Self-Assessment. One important area of testing critical skills is the student's ability to self-test. Kulthau believes that students should assess their own research process by rethinking what they did and making suggestions for ways to accomplish the task differently and more efficiently or to repeat what they have done because it was successful. Working with teacher and students to create the criteria has been discussed previously. McGregor found

> that students tend to be product-oriented when using information [which] suggests more emphasis needs to be placed on processes--processes of learning, discovering, researching, thinking, sense-making, and thinking about thinking. Too much emphasis on product leads to copying and thinking on a more superficial level than process orientation. Teaching students to reflect on their thinking and providing a metacognitive environment can encourage attention to process. Students who become more aware of process will learn to value their own thinking and learning. They need to learn to take responsibility for monitoring their thinking and learning and for using effective thinking strategies at appropriate times. This should begin to take place early in their educational careers so that habits of productive thinking and learning are developed throughout the years they spend in school.[2]

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[1] J. Killoran, "In Defense of the Multiple Choice Question," 56: 106-108 *Social Education* (February 1992).

[2] McGregor, *op. cit.*, p. 132.

Performance/Presentation Measures. Performance assessment could be carried out when a student chooses, then narrows a topic, chooses the audience as well as the occasion, and then determines the speech, the topic, the reason for the presentation, choosing the supporting material, and writing the presentation. According to Spicer, performance assessment should have meaningful context, use the thinking process in the assessment, have an appropriate product or performance, guide rather than limit instruction, and have multiple performance levels.[1] Products or performances relate to the content of what is being assessed. Any "test" should have meaning for both student and teachers if both are to be motivated. Agreed upon criteria are applied to the assessment process.

Students should present their projects to others, sharing the new knowledge they have created, and teaching others their process. Including parents and the community in the performance further extends the "value" of this. Planning the actual performance as a celebration as well as a learning exercise becomes a further enhancement of critical thinking skills.

Performance tasks to be assessed include, as stated above, planning a performance. Students could create an experiment, design a building, solve multi-step problems, undertake group work assessment, and participate in debates. The processes followed for debate are applicable in other situations.

Students should be expected to evaluate and analyze the performance of others, helping create the "standard" measure for effective performance. This process also helps them learn to evaluate their own performance.

Checklists. Setting criteria has been discussed previously. Transferring criteria to a checklist is a matter of formatting and setting a scale when appropriate.

Interviews. Ennis and Norris[2] discuss interviewing in their paper. Interviews help students "perform" in the interview discussing the steps they followed, the conclusions drawn, the alternatives explored and rejected. Audio or video recording of an interview, if it doesn't interfere with the process, allows freedom from notekeeping but increases the time involved since the tape would need to be reviewed. Media specialist and teacher share the task of recording the interview; when a video is made, all parties review the interview together to "score" the achievement of the student.

Writing to Evaluate Thinking. Writing to evaluate thinking combines logs and journals, writing essays and reports, and scripting and editing skills. The fact that standardized tests such as the SATs now include essays as a part of their testing indicates the importance being placed on this test for judging critical thinking skills as well as essay writing skills. Tests in this area must confirm that students have focused on a problem and have organized their thoughts. The information they write should be clear, relevant, appropriate, and credible.

A common means of using writing to evaluate thinking include logs or journals to record problem solving strategies. With word processing, this is not as painful as it once seemed to students. Baron recommends having students report in their log their reflections of what had happened that day. "Such entries allow the teacher to evaluate whether students have internalized the basic principles of the lesson, whether they can transfer the principles appropriately, and/or what questions they still have."[3]

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[1] Spicer, pp. 8-9.

[2] R.H. Ennis and S.P. Norris, "Critical Thinking Assessment: Status, Issues, Needs." in *Cognitive Assessment of Language and Math Outcomes*, edited by J. Algina and S. Leggs (Norwood, NJ: Ablex Publishing, 1990).

[3] Baron, *op. cit.*, pp. 221-247.

Resnick and Klopfer[1] suggest having students write an essay for an "interested audience" not just for a grade, stretching their minds with a difficult text and formulating questions or making comparisons. These provide evidence for evaluating writing to evaluate thinking.

Quality of Resources Chosen. A further test of the writing process would include an analysis of the quality of the resources the student used in completing the assignment. The strong probability exists that an article in *New England Journal of Medicine* is more intellectual than *Time* which might be considered more intellectual than *People*. Judging the hierarchy of content quality in various sources requires the media specialist. This intervention could be extremely critical since many teachers lack experience in judging quality of resources. It also means the media specialist remains aware of reviews of materials and seeks expert opinion when judging purchases. The task of teaching *quality* of resources requires more preparation than the traditional lesson in use of the on-line public access catalog which was a location of resources rather than analysis of relevance, accuracy, and other criteria. It also implies that the media center has review sources available for students and teachers to access and that they are aware that they should use those resources to check further the quality of resources they find.

Portfolio Assessment. Portfolios containing writing and artwork, videos of performances, audio or videotape records of discussion become skills measures. They are measured using pre-established criteria.

Direct Observation. Observation criteria analysis may be confirmed by reviewing a videotape or even by listening to an audiotape. Anecdotal notes are taken and checklists are used to score activities.

Questioning Techniques. King[2] recommended having students sort questions into logical patterns and checking to see how well they are able to do this. Another assessment would be the students' ability to develop research question(s) before beginning a research assignment.

Search and Location Strategies. Gibson[3] suggests assessing "... the ability to formulate a search strategy well, to know what makes a good search strategy and what makes a poor one." Having students analyze each other's search strategy as well as teacher and media specialist should expand this assessment strategy into a demonstration of critical thinking.

Evaluating Evaluation. Baron gives ten characteristics of effective evaluations of critical thinking. These are provided as a checklist in Appendix C. Beyond this, media specialist and teachers remain vigilant that what they measure truly measures what they intended to measure. Researchers must aid practitioners in determining reliability and validity of testing measures.

Implications for the Practitioner

To be most successful in teaching critical thinking, instruction must move across curriculum and across grade levels. The first challenge will be to work to change teaching methods, and this is never simple. Accepting the media specialist, a peer, as teacher of teachers somehow seems to diminish perceptions of competence in other staff. While teachers may accept new or review of concepts from an outside expert, it will take a great deal of effort on the part of the media specialist to "sell" teaching method changes. Staff can be very reluctant to give up their textbooks, course outlines, their pet topics, and their daily plan books.

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1 L.B. Resnick and L.E. Klopfer, eds., *Toward the Thinking Curriculum: Current Cognitive Research* (Washington, D.C.: Association for Curriculum Development, 1989).

2 King, *op. cit.*

3 Gibson, *op. cit.*, p. 32.

For teachers to whom critical thinking skills was a very small part of their undergraduate or graduate education and who have not kept up with this concept and the changes teaching critical thinking skills will require must be introduced to this concept with as little effort as possible on their part. Convincing them about the benefits to students and the interest this may engender in their students as well as the help being offered from the media center must overcome their sense of added work with little or no proven benefit. When *collaboration* is a new word, a new concept, a new way of teaching, getting this to happen requires support from the principal, people skills, a little luck, and a great many resources in the media center.

Practitioners who wish to begin assessment of their influence on critical thinking skills should conduct action research such as checking search strategies and use of available resources for their relevance and quality. Callison[1] suggests that one "test" of success is the ability of the student to transfer learning to other areas of the curriculum, and an excellent measure of success would be that students were not satisfied to stop at this point, but to continue to explore.

Few media specialists have time to plan, conduct, and write up research results. For a non-district employee to get into a school to "test" students becomes increasingly more difficult, especially when that research may involve something more than a test of two methods of teaching a skill. Because assistance with evaluation should expand the quality, practitioners will gain by inviting researchers to help plan, execute, record, and publish results.

The need for test results over time, the need for more sets of eyes to conduct the evaluations, and the time involved in any qualitative assessment place the media specialist in a very important role in critical thinking instruction. Sharing evaluation of this process, one person to observe while another teaches, involves the collaboration of teacher and media specialist. Adding a researcher to this process benefits everyone.

Implications For the Researcher

Any long-term studies, the analysis of findings, and reporting in the literature would seem to fall to the researchers for whom such is the fabric of their lives. To anticipate that building level media specialists will have time to do much more than gather the data rather presupposes that teaching critical thinking skills requires little effort, and we know that is not true.

A first experiment should be the relationship of size and quality of resources available to the improvement of critical thinking skills. We know from Lance[2] that size of collection affects achievement scores, but does it affect critical thinking?

How could the library media specialist increase teacher interest in critical thinking skills with inservice sessions and what would be the outcome? Or, if collaboration is an essential ingredient to planning units of instruction that foster critical thinking skills, can intervention by an outside person conducting workshop sessions better encourage teacher/media specialist interaction than principal-led teacher/media specialist led or media specialist alone?

Halpern suggests that little is known about individual student variables that contribute to the ability to think critically. "Which courses and which curricula develop the best thinking skills? Do individual learning styles or preferred modes of thought predict the attainment of specific thinking skills? These questions provide the theory of critical thinking and outline what researchers should begin to test."[3]

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[1] Callison, *op. cit.*, p. 84.

[2] K.C. Lance, L. Welborn, and C. Hamilton-Pennell, *The Impact of School Library Media Centers on Academic Achievement* (Castle Rock, CO: Hi Willow Research and Publishing, 1993).

[3] Halpern, *op. cit.*, 252.

Conclusion

This paper has not answered the questions; it has posed the background so we can work on answers. Certainly one outcome of this paper has been an increase in the critical thinking of its author about critical thinking. It took much longer to prepare because the topic required retrospection and it was difficult to eke out time for quiet analysis. What is certain is that media specialists, because of their relationship to all teachers, students, and curriculum, remain keys to the development of critical thinking skills in students in our schools.

If we hope to prepare students to be life-long learners, using their critical thinking skills, we must strive to help them learn how to access and apply knowledge at the appropriate time and place when conditions merit use of that knowledge. This seems to be a challenge we must undertake even though we may not ever learn how successful and unsuccessful we might have been. We must help produce students who will be better thinkers in the school-to-work environment so they will be better thinkers in the real world.

Appendix A

Using the Ennis Model

Given an assignment to create a formal report, possible checkpoints at three levels include:

Clarity
(Focusing on a question)
Student is able to identify a problem.
Student is able to propose an hypothesis.
Student is able to judge if the hypothesis is acceptable.
(Analyzing arguments) Note: This may have some overlap with the above.
Student finds a variety of statements to answer the question.
Student finds a variety of statements to support the hypothesis.
Student finds a variety of statements identifying arguments that are not explicitly stated.
Students is able to determine relevance of statements.

Asking Questions
(Asking appropriate, clarifying questions)
Student is able to analyze the amount of information found.
Student is able to determine if enough information has been located to prepare the report.
Student has sufficient background knowledge to continue.

Advanced Clarity
(Defining terms)
Student understands where to locate definitions.
Student can determine the "best" definition from those in source.
Student can expand the existing definition with examples.
(Identifying assumptions)
Student can point out assumptions an author has stated.
Student can state assumptions that author has made but not stated.
Student can describe assumptions that author might have used.

Basis
Of primary concern in matters related to the content and credibility of the Internet.
(Judging credibility)
Students check credibility of content, only.
Students check credibility of content and sources.
Students check credibility of assumptions made from stated facts in content.
(Observation)
Student is able to take credible notes.
Student is able to observe information sources and incorporate new findings into report.
Student is able to transfer observations from previous experience or to transfer learning to other areas of the curriculum.

Inference
Includes deductive inference, inductive inference, and inference to value judgments.
(Deducing and judging deductions)
Student is able to judge cause and effect.
Student is able to analyze whether necessary conditions are satisfied.
Student is able to interpret double negatives in sentences.
(Inducing or inductive influence)
Student is able to generalize and infer to hypotheses that are supposed to explain the facts. Does smoking cause cancer?

Making value judgments
(Make value judgments)
No plausible alternatives

Deciding on an Action

Interaction
Interacting with others in discussions, presentations, debates, and written pieces
Student participates in discussion.
Student leads discussion.
Student plans discussion.
Employing Fallacy Labels
Student detects errors in statements of fact.
Student detects errors in assumptions and hypotheses.
Student revises assumptions and hypotheses.
Interdependence

Appendix B

A Collection of Objectives/Criteria
Objectives of a Process to Assess Higher Order Thinking
Paul and Nosich

1) It should assess students' skills and abilities in analyzing, synthesizing, applying, and evaluating information.

2) It should concentrate on thinking skills that can be employed with maximum flexibility, in a wide variety of subjects, situations, contexts, and educational levels.

3) It should account for both the important differences among subjects and the skills, processes, and affective dispositions that are crucial to all the subjects.

4) It should focus on fundamental, enduring forms of intellectual ability that are both fitted to the accelerating pace of change and deeply embedded in the history of the advancement of the disciplines.

5) It should readily lead to the improvement of instruction.

6) It should make clear the inter-connectedness of our knowledge and abilities, and why expertise in one area cannot be divorced either from findings in other areas or from a sensitivity to the need for interdisciplinary integration.

7) It should assess those versatile and fundamental skills that are essential to being a responsible, decision-making remember of the work-place.

8) It should be based on clear concepts and have well-thought-out, rationally articulated goals, criteria, and standards.

9) It should account for the integration of communication skills, problem-solving, and critical thinking, and it should assess all of them without compromising essential features of any of them.

10) It should respect cultural diversity by focusing on the common-core skills, abilities, and traits useful in all cultures.

11) It should test for thinking that is empowering and that, when incorporated into instruction, promotes (to quote the September, 1991 Kappan) "the active engagement of students in constructing their own knowledge and understanding."

12) It should concentrate on assessing the fundamental cognitive structures of communication, for example: *with reading and listening,* the ability to

- create an accurate interpretation,
- assess the author's or speaker's purpose,
- accurately identify the question-at-issue or problem being discussed,
- accurately identify basic concepts at the heart of what is said or written,
- see significant implications of the advocated position,
- identify, understand, and evaluate the assumptions underlying someone's position,
- recognize evidence, argument, inference (or their lack) in oral and written presentations,
- reasonably assess the credibility of an author or speaker,
- accurately grasp the point of view of the author or speaker,
- empathetically reason within the point of view of the author or speaker.

with writing and speaking, the ability to

- identify and explicate one's own point of view and its implications,
- be clear about and communicate clearly, in either spoken or written form, the problem one is addressing,
- be clear about what one is assuming, presupposing, or taking for granted,
- present one's position precisely, accurately, completely, and give relevant, logical, and fair arguments for it,
- cite relevant evidence and experiments to support one's position,
- see, formulate, and take account of alternative positions and opposing points of view, recognizing and evaluating evidence and key assumptions on both sides,
- illustrate one's central concepts with significant examples and show how they apply in real situations,
- empathetically entertain strong objections from points of view other than one's own.

13) It should assess the skills, abilities, and attitudes that are central to making sound decisions and acting on them in the context of learning to understand our rights and responsibilities as citizens, as well-informed and thinking consumers, and as participants in a symbiotic world economy.

14) It should avoid any reductionism that allows a multi-faceted, theoretically complex, and authentically usable body of abilities and dispositions to be assessed by means of oversimplified parts that do not adequately reflect the whole.

15) It should enable educators to see what kinds of skills are basic for the future.

16) It should be of a kind that will assess valuable skills applied to genuine problems as seen by a large body of the populace, both inside and outside of the educational community.

17) It should include items that assess both the skills of thoughtfully choosing the most reasonable answer to a problem from among a pre-selected set and the skills of formulating the problem itself and of making the initial selection of relevant alternative.

18) It should contain items that, as much as possible, are examples of the real-life problems and issues that people will have to think out and act upon.

19) It should be affordable.

20) It should enable school districts and educators to assess the gains they are making in teaching higher order thinking.[4]

21) It should provide for a measure of achievement against national standards.
Brookfield's Criteria (S.D. Brookfield. *Developing Critical Thinkers: Challenging Adults to Explore Alternative Ways of Thinking and Acting.* (San Francisco: Jossey©Bass, 1989))

- Recognizing when students have identified and challenged assumptions:
- Students who question the content of their text books
- Students who question why a news broadcast feature certain stories and leave out a happening in their school.
- Recognizing when students have contextual awareness:
- Behavior: Students who understand the teacher's applications of punishment for classroom misdemeanor

- Culture: Students (particularly males) who recognize their parents will not approve of an ear ring because that was not an event in their families, or families who pierce ears at a very young age.
- Imaginative students who recognize and explore alternatives to their way of thinking, alternatives that are normal and self-evident but lead to reflective skepticism.
- Helping another student learn a process is time well spent and increases the student's comprehension when acting as "teacher."
- Work to change a rule that seems archaic and meaningless, e.g., two-week checkout period for library materials and work to set up a student responsibility posture to bring in recalled materials but have all others for the semester.
- Look for sustained effects and not immediate recall.

Appendix C

Baron[1] (expanded)

Formative-summative evaluation reminds us of writing evaluation for proposals for funding. Formative evaluation, the "weekly test" is given throughout the instruction so that mistakes in both the teaching of critical thinking skills and evaluation of the assessment process can be corrected and methods improved. The final test of teaching and testing is the summative evaluation.

Product-process evaluation includes what the student produced (product) and how the student went about producing the product (process). The product might include test scores, self reporting mechanisms such as a log, and samples and examples of their work. Observation would help determine if the students were on task and enthusiastic about their assignment. Animated discussion about the assignment could provide a "high score" for process as well as test results when a critical thinking test accurately measures improvement.

Qualitative-quantitative evaluations include observational and numerical test reports. The qualitative assessments look at student progress detailing experiences in depth. Such qualitative reports are very time consuming. Qualitative achievements measure a skill to be achieved and a mechanism for rating progress toward that skill and a level that a student has reached. Measures need careful reflection to distinguish these levels of achievement.

Quantitative assessments record the numerical scores on tests, the questionnaire given to students to determine their interest, surveys of teachers and parents concerning their opinions of the progress of students. While quantitative evaluations are easy to score, such formats as questionnaires to be unbiased need to be anonymous.

Experimental-Quasi-Experimental Designs require control groups, never easy to obtain in a classroom situation where withholding teaching to create the control is interpreted as providing unequal education. The lack of control of the various variables makes this difficult as an evaluation model that media specialist practitioners or researchers can implement.

[1] J.B. Baron, "Evaluating Thinking Skills in the Classroom," in *Teaching Thinking Skills: Theory and Practice*, edited by J.B.Baron and R.J. Sternberg (New York: W.H. Freeman and Company, 1987): p. 222-23.

Appendix D[1]

Criteria: Students...	1	2	3	4	5
Challenge one another for reasons and examples.					
Offer counter examples, counter instances, and counter arguments.					
Piggyback on one another's comments.					
Identify the function of their comments (e.g., I would like to comment on A, add to B, or disagree with C.					
View themselves as scholars discussing worthwhile materials.					
Search for and present relationships between the subject under discussion and other relevant school subjects and outside experiences.					
Relate the specific subject under discussion to more general principles.					
Ask relevant and sequential questions.					
Don't take things for granted, but ask for justification.					
Ask for clarification (e.g., "What do you mean?")					

[1] J.B. Baron, "Evaluating Thinking Skills in the Classroom," in *Teaching Thinking Skills: Theory and Practice*, edited by J.B. Baron and R.J. Sternberg (New York: Wh.H. Freeman and Company, 1987): pp. 230-31.

Appendix E[1]

Evaluation Checklist for Measures of Critical Thinking

Evaluation	Yes	To Improve
The program being evaluated took place?		
Performance of students was tested before and after the program was introduced.		
Did unintended effects (or side effects) occur in addition to the program's desired effects?		
Was data gathered on a variety of measures and activities?		
Were tests used that were able to measure the desired changes?		
Were unobtrusive measures used (to minimize the Hawthorne effect).		
Were observations included of changes that did not occur immediately.		
Were changes that occurred early in the program sustained over time?		
Were thinking skills taught for specific situations transfer over to more general situations?		
Do the results have meaning, both positive and negative?		
Can the evaluator understand the implications and limitations for decision making?		

[1] J.B. Baron, "Evaluating Thinking Skills in the Classroom," in *Teaching Thinking Skills: Theory and Practice,* edited by J.B. Baron and R.J. Sternberg (New York: W.H. Freeman and Company, 1987): p. 224.

Appendix F

A series of evaluation activities from the preceding paper match the definition of critical thinking proposed by the descriptors given by Paul and King. The final four were taken from Halpern. They are proposed for observing, planning, reflection, discussion, expansion, deletion, revision, rearranging among other outcomes.

Conceptualize
observations: differences in genres of literature, autobiographies, fiction, fantasy, news story, travelogues, among others.
experiences: Students bring in past experience for future planning
reflecting: Students plan rather than proceed by trial and error
reasoning:
communication: Communication in all areas increases based upon knowledge gained through the choice and use of information from a variety of resources.
Students brainstorm, discuss potential topics

Apply
observations: Explore the literature
experiences: Use retention (memory strategies)
reflecting
reasoning
communication

**Analyze[1]
observations: Fact vs. fiction beginning with picture books.
experiences: Identify information needed to complete the task.
reflecting: Different perspectives of a contemporary issue
reasoning: Relationship between events and issues; understand difference between correlation and cause
communication: Compare two speakers debating a topic.

Synthesize
observations
experiences: Develop the question or problem to be explored.
reflecting: Seeking patterns.
reasoning: Bringing meaning out of apparent disorder. Incorporating anomalous data into a coherent framework.
communication: Raising questions.

**Evaluate
observations: Which newscast/editorial/article is biased toward one political party or another; relevant and irrelevant sources; distinguish between reliable and unreliable resources.
experiences: multiple criteria in evidence, some in conflict
reflecting: Critically evaluates print and nonprint in academic and non-academic settings
reasoning: Student questions all sources of information; select factual materials that are accurate, authoritative, current, multiculturally accurate, understandable.
communication: Lead small groups in selection of appropriate materials for projects

[1] Halpern identifies those activities with ** as cognitive.

**Infer
observations: Raises problems and suggests solutions
experiences: Confirms facts in historical fiction; sets science fiction into its probability based upon present scientific fact; can successfully transfer previously learned information to other curriculum areas.
reflecting: uses analogies
reasoning: move from a result in one discipline to a probable result in another
communication

**Compare/Contrast
observations: two versions of a fairy tale; two reference books with similar information
experiences: local political platforms with state and national political platforms
reflecting: relationship between events and issues
reasoning: Boolean Searches: seeks patterns
communication: Compare two versions of the same time period through collection of oral histories; versions of the same news from articles in different reporting sources

Verify
observations: making spatial representations
experiences: understands principles of likelihood and uncertainty
reflecting: Choose appropriate activity to complete a task: reading, researching, listening or viewing, producing, working in small groups, computing, or teleconferencing.
reasoning: confirming fact in another source communication:

Substantiate
observations: Choose a fact and confirm its validity
experiences: Select appropriate reference tool to confirm fact
reflecting: Place new fact into previous learning
reasoning: provide support for a conclusion; provide reasons and evidence for opinions
communication: Share new information with others

Explain
observations: evaluate a scene based upon its authenticity much as evaluators of picture books confirm the text matches the picture.
experiences: Explain a proposition in such a way as to gain support of others after the presentation.
reflecting
reasoning
communication

Hypothesize
observations
experiences: multiple solutions with costs and benefits; restructure problems
reflecting: not everything bearing on the task at hand is known, hypothesize alternatives
reasoning: generate hypotheses; supportive evidence/counter evidence for debate responses
communication: debate alternative hypotheses

Metacognition
observations
experiences
reflecting
reasoning
communication

Plan
- observations
- experiences
- reflecting
- reasoning
- communication

Monitor
- observations
- experiences
- reflecting
- reasoning
- communication

Review/Revise
- observations
- experiences
- reflecting
- reasoning
- communication

Author Biographical Notes

Blanch Woolls is the Director of the School of Library and Information Science at San Jose State University. She is a past president of the American Association of School Librarians and is currently the chair of the Legislation Committee of that organization. She is also a member of the Council of the American Library Association.

I have participated in every Treasure Mountain Research Retreat and find it a unique opportunity to share and think through critical research issues with colleagues and practitioners. I do believe it is the responsibility of researchers to make the transition from theory to practice, while practitioners must identify themselves as ready to help with the "testing" process. This will expand the research available for our field.

TESTING AN INTERDISCIPLINARY ASSESSMENT MODEL[1]

Robert Grover
Jacqueline McMahon Lakin
Jane Dickerson[2]

Abstract

Library media specialists in Kansas have been engaged in the teaching of information skills as part of an integrated curriculum advocated by Quality Performance Accreditation, a process which accredits schools based on student performance, i.e., a school's quality is judged by how well all of its students are performing and their continual academic improvement. Needed are assessment models and the education of library media specialists, teachers, and administrators to implement those models. To address these needs, the Kansas Association of School Librarians (KASL) Research Committee has created an interdisciplinary model for assessing learning across the curriculum.

The Committee, in collaboration with the Kansas State Department of Education, is engaged in a research project which is testing the assessment model. This paper presents preliminary results of data gathered through the mid-point of the study (December, 1996). Data gathered indicate that the model is useful as a planning guide for teachers as well as a learning tool for students.

The Problem

In 1991 the Kansas State Department of Education began a statewide school improvement process when it adopted the Quality Performance Accreditation system. Unlike past accreditation methods which focused on such things as the number of books in libraries or the square footage of buildings, Quality Performance Accreditation accredits schools based on student performance, i.e., a school's quality is judged by its students' academic performance and their continual academic improvement. Furthermore, the Quality Performance Accreditation system requires all educators to be collaborative in the design, implementation, and assessment of instruction.

Since 1993 the Kansas State Department of Education, in collaboration with educators throughout the state, has developed and adopted curriculum standards in the content areas of mathematics, communication, social studies, and science. Library media specialists in Kansas have developed library media program outcomes in alignment with the National Education Goals 2000 and the Kansas Quality Performance Accreditation system. These newly drafted library media program outcomes support the concept of integrated instruction as proposed in subject area curricular standards.

Parallel to the national trends for library media specialists to become engaged in the teaching of information skills integrated into subject areas at all grade levels, the Kansas Association of School

[1] This project is funded in part by the AASL/Highsmith Research Grant.

[2] While the persons listed were responsible for writing this paper, all committee members contributed ideas to the model presented here. Those KASL Research Committee members are: Shelia Blume, Judy Burbach, Carol Fox, Jim Hathaway, Latane Kreiser, Betsy Losey, Roma McConkey, Mary Schumacher, and Rosemary Talab. The authors wish to thank Carol Fox for her editorial help in preparing this manuscript.

Librarians (KASL) Research Committee, in collaboration with the Kansas State Department of Education, embarked on a project to develop a model for assessing learning across the curriculum. During 1994-95 the KASL Research Committee conducted a literature review and developed a preliminary assessment model. During summer, 1995, the Committee organized a two-day summer institute to refine the model and to develop rubrics for an interdisciplinary model for assessing learning across the curriculum. Participating in development of the model were teachers, administrators, and Kansas State Department of Education curriculum specialists. In fall, 1995, the Research Committee met to review and refine the model, including the rubrics for assessment. After revising the model, the Committee members presented the model for reactions at six regional workshops sponsored by KASL. Feedback from these presentations was favorable, and suggestions were incorporated in a second revision of the model in January, 1996.

During spring, 1996, the Committee received the American Association of School Librarians/Highsmith Research Award to test the model in a sample of Kansas schools. This paper will describe the Interdisciplinary Assessment Model and the preliminary results of research testing the model.

Development of an integrated assessment model required an examination of assessment strategies, establishment of a common language for library media specialists to work in various curriculum areas, a comparison of current state standards for subject areas, and, finally, creation of rubrics for each stage of the assessment model. Each of these steps will be discussed in turn.

In Search of A Common Language

"Assessment of student learning, the measuring of student's progress and performance . . . is being given serious attention across disciplines and at all levels of education." (Kuhlthau, 1994, p. IX) The problem encountered by library media specialists is integrating assessment across disciplines and grade levels. Needed is a common language, or model, to allow grade level or curricular area experts to communicate effectively.

Library media specialists currently integrate knowledge of the learning outcomes of each discipline or level of education with outcomes for critical thinking and information problem solving skills. Integration of instruction and assessment at this level demands an understanding of the vocabulary of each discipline as well. The goal of the KASL Research Committee was to find a common language among the Kansas State Department of Education assessment guidelines for reading, mathematics, social studies, science, Six-Trait Writing, and information problem-solving.

The Eisenberg/Berkowitz Big Six model provides the common language for library media specialists teaching information problem-solving. This model presents six steps for problem solving (Eisenberrg and Berkowitz, 1990, p. 24):

1. Task Definition: define the problem and identify the information requirements of the problem.

2. Information Seeking Strategies: Determine the range of possible sources and evaluate the different possible sources to determine priorities.

3. Location and Access: Locate sources (intellectually and physically) and find information within sources.

4. Information Use: Engage (e.g., read, hear, view) the information in a source and extract information from a source.

5. Synthesis: Organize information from multiple sources and present the information.

6. Evaluation: Judge the product (effectiveness) and judge the information problem-solving process (efficiency).

This Big Six model became the framework for establishing a common language across disciplines. The other common ground was the teaching process. The problem of interdisciplinary collaboration involves synthesizing complex, specific language and learning outcomes into a model that can be used effectively by teachers from all disciplines and grade levels and by library media specialists.

The common language for interdisciplinary collaboration evolved from an examination of the teaching process by Jane Dickerson, Library Media Specialist at Morse Elementary School, Blue Valley Schools. Ms. Dickerson perused Kansas standards for reading, mathematics, social studies, science, and Six-Trait Writing, as well as The Big Six, and created the following model which serves as the "common language" for these areas, with teaching as its focus. This teaching model identifies the following five steps, which are defined below:

1. Assignment
2. Plan of action
3. Doing the job
4. Finished product
5. Evaluation

All teacher/library media specialist collaborative teams begin with an *assignment.* This assignment aligns district and school curricular learning outcomes with appropriate discipline/grade level/unit outcomes. This integrated assignment and its outcomes are directly tied to the assessment that will allow the collaborative team to determine each student's current progress. The assignment requires the student to have a clear, complete understanding of the assignment or problem. The assignment creates a focus for successful task completion and evaluation.

The *plan of action* occurs when the teacher(s) and the library media specialist determine which discipline-related, problem-solving, and instructional strategies the student must use to complete the assignment successfully. The *plan of action* requires the student to choose the most appropriate strategy(ies) and give reasons for his/her choice(s). The *plan of action* may entail the analysis of tools, experiences, and available resources that would facilitate meeting the requirements of the assignment.

Doing the job causes the student, teacher(s) and library media specialist to focus on the requirements needed to complete the assignment (job) with all components in evidence. To successfully do the job, the student must have a clear understanding of the assignment/problem and choose the most appropriate strategy(ies) for completing the assignment. This step of the teaching model combines steps three and four of the Big Six, i.e., Location and Access, and Information Use.

The *finished product,* the completed assignment, reflects quality and the student's understanding of most facets of the problem. This product may be a correct response to a question, the solution to a mathematical equation, a report, chart, cooperative learning activity, research paper, or invention, as well as other forms of authentic assessment.

Evaluation is conducted by the teacher(s) and library media specialist with the student to appraise the student's completion of the assignment. The evaluation must be aligned with the assignment, the plan of action, doing the job, and the finished product. This evaluation rates the product and problem-solving process and requires the student to give reasons for the evaluation. Such assessment may enhance opportunities for the student to transfer this knowledge to a "real life" situation.

The terms in the integrated teaching model represent a common language for discussing instruction with teachers from various subject areas. Using this model and The Big Six, terms were drawn from Kansas subject area standards to prepare the following table of comparisons.

Table 1
Comparing Teaching Stages Across Subject Areas

Integrated Model	Information Problem Solving	Reading	Reading	Math	Social Studies	Six-Trait Writing
Assignment	Define task	Read selection Read question	Under-stand the problem	Identify Issue for investigation	Recognize and define the problem	Develop ideas & content for audience
Plan of action	Develop information seeking strategies	Outline key terms & concepts	Choose problem solving strategy	Develop a plan for the investigation	Design a problem solving strategy	Further develop ideas and content for audience
Doing the job	Locate, access & use information	Choose appropriate information sources	Implement a problem solving strategy	Acquire informaiton from sources; organize information	Implement a problem solving strategy	Refine the voice including strategy flow; proof-read
Finished Product	Synthesize & present the information	Apply Appropriate Information sources	Find & report conclusion	Choose & justify on the issue; present results	Interpret & communicate findings & conclusions	Submit to editor; revise
Evaluation	Evaluate process & product	Check response for understanding, accuracy & completeness	Evaluate conclusion for reasonableness of results	Evaluate process & product of the investigation	Evaluate findings for clarity, accuracy & real life applications	Publish; evaluate for audience reception & logic

Designing Rubrics for an Integrated Assessment Model

Numerous assessment strategies were reviewed by the Research Committee, resulting in the selection of rubrics for application in the integrated assessment model. Rubrics are guidelines for evaluation; they are intended to provide qualitative descriptions or measures of the student's progress towards stated outcomes. Rubrics were developed, submitted to practitioners for reaction, and revised. Based on these reactions and preliminary application in classrooms, a generic rubric was created. The KASL Research Committee designed a rubric with four levels plus a state of nonachievement. Following are these levels, with level #4 the highest level of achievement:

NA Not applicable or no evidence is available
1 Awareness
2 Understanding
3 Demonstration
4 Application

A rating of *NA* indicates that the student has produced no evidence that s/he attempted to address the assignment. There is no basis for evaluation.

A rating of *1* indicates awareness or knowledge of the process or product, as indicated by evidence the teacher and library media specialist have gathered. For example, in stage 1, the integrated assignment, the student in some way demonstrates awareness of the assignment or problem, e.g., verbally, nonverbally, or through a product.

"Understanding," a rating of *2*, indicates that the student has a basic comprehension of the problem or process, often expressed verbally.

"Demonstration," a rating of *3*, results from evidence provided by behavior and/or example.

Rating *4*, "application," suggests that the student has integrated the knowledge and is able to apply it in a real-life situation.

For each stage of the model, i.e., "Integrated Assignment," "Integrated Plan of Action," etc., the rubric described above is applied. For example, the "Integrated Assignment" provides the following rubrics:

4 Articulates a clear, complete understanding of assignment/problem.
3 Demonstrates understanding of most of assignment/problem.
2 Shows vague, unfocused understanding of assignment/problem.
1 Is aware of assignment/problem.
NA Not applicable/nothing available

The rubrics for each stage of the model are presented in Table 2. These rubrics, combined with the integrated teaching model, provide library media specialists and teachers with a tool for planning, implementing, and assessing the integrated teaching of information skills. The complete model is found in the appendix. The section which follows describes the research which is testing the assessment model.

Table 2

Rubrics for the Integrated Assessment Model

Integrated Assignment	**Integrated Plan of Action**	**Integrated Doing the Job**	**Integrated Finished Product**	**Integrated Evaluation**
4-Articulates a clear, complete understanding of assignment/ problem.	**4**-Chooses the most appropriate strategy(ies) and gives reasons for choice.	**4**-Completes the assignment (job) with all components in evidence.	**4**-The quality of the product reflects an understanding of most facets of the problem.	**4**-Evaluates the product and problem-solving process and gives reasons without assistance.
3-Demonstrates understanding of most of assignment/ problem.	**3**-Chooses a strategy after comparing possibilities.	**3**-Submits the assignment (job) with few components missing.	**3**-The quality of the product reflects an understanding of many facets of the problem.	**3**-Evaluates the product and problem-solving process and gives reasons with assistance.
2-Shows vague, unfocused understanding of assignment/ problem.	**2**-Chooses a strategy without comparison to other possibilities.	**2**-Submits assignment (job) with many components missing.	**2**-The quality of the product reflects understanding of some facets of the problem.	**2**-Understands the evaluation process but gives few reasons, even with assistance.
1-Is aware of assignment/ problem.	**1**-Is aware of different strategies.	**1**-Is aware of assignment (job) but has difficulty proceeding.	**1**-The quality of the product reflects understanding of few facets of the problem.	**1**-Completes the assignment but cannot give reasons for the errors in the product and problem-solving process.
NA-Not applicable/ nothing available.	**NA**-Not applicable/ nothing available.	**NA**-Not applicable/ nothing available.	**NA**-Not applicable/ nothing available.	**NA**-Not applicable/ nothing available.

Purpose of the Study

The goal of this research project is to evaluate the KASL Interdisciplinary Assessment Model in various curriculum areas and to gather data for revising it. To address this goal, the objectives of the project were identified as follows:

1. Assemble a knowledgeable Research Advisory Committee to oversee planning and implementation of the research project.

2. Identify a sample of participating pilot schools which will gather data to test the KASL Assessment Model.

3. Collect data on student learning, student and teacher attitudes, collaboration of teachers and library media specialists, and assessment strategies during the 1996-97 academic year in at least 10 school districts of varying sizes throughout the state of Kansas.

4. Revise the assessment model based on an analysis of the data.

5. Disseminate the revised model throughout the state and nation.

Planning the Study

The KASL Research Committee identified Research Advisory Committee members who typified staff from the Kansas State Department of Education, school library media specialists at various levels, subject area teachers, and school administrators. The Research Advisory Committee met twice in August, 1996, to recommend research strategies and possible schools to participate in the study. The Advisory Committee continues to monitor the project through reports sent to members.

To assist in the planning and implementation of the project, the Research Committee identified an independent research consultant, Delia Neuman, Associate Professor, College of Library and Information Services, University of Maryland. Dr. Neuman participated in the design of the study, selection of research methods, and selection of schools by participating in meetings of the Research Advisory Committee. She also participated by telephone in meetings of the researchers to address researchers' questions regarding data collection techniques and analysis of results.

Following are the research questions adopted for the project:

1. How does the model's usage facilitate student learning in selected grade levels and subject areas?

2. How does use of the model influence collaborative planning and integrated instruction?

Selecting Schools

Schools were selected to assure diversity on each of the following criteria: (1) level, i.e., elementary, middle school, high school, (2) size of school, (3) whether rural, suburban, or urban; (4) school climate, i.e., amount of integration of the teaching of information skills; and (5) library media specialist knowledge of the assessment model (all had attended workshops at which the model was described and used).

Due to time constraints (the researchers are employed in professional positions which limit their availability for travel and data collection), two categories of participating schools were established--case study schools and self-reporting schools. In consultation with the project consultant, the researchers agreed to concentrate efforts on three sites, representing elementary, middle, and high schools. These were designated "case study schools." One researcher was assigned to work with each case study school on a regular basis to visit, conduct interviews, and observe use of the model. The researchers observe lesson presentations and interview participating teachers and library media specialists. The researchers also regularly contact the library media specialists by telephone.

A second type of school was designated "self-reporting." Library media specialists at self-reporting schools complete a "School Information Form," and their "research partner," a member of the Research Committee, contacts the library media specialist approximately every two weeks, using an interview guide. No school visits are made, but continuous monitoring of the model's use is accomplished through telephone contact.

Research Methods

Research methods were recommended during the meetings of the Research Advisory Committee and during subsequent phone consultations with the research consultant. Phone conferences with the research consultant were augmented with faxed copies of instruments developed by the researchers and electronic mail communication. Instruments were created to gather data collected through interviews, classroom observations, and school walkarounds.

Precise data-gathering instruments were required to ensure standardization of data collection by the team of researchers, who included one half-time elementary school library media specialist, two full-time elementary school library media specialists, two high school library media specialist's, one graduate student, one state department consultant, and one library and information science school faculty member. One researcher was assigned to each of the ten participating schools. Researchers working with case study schools had that school as their only assignment, while researchers working with self-reporting schools had one or two schools assigned. The graduate student and faculty member, who had more flexibility in their daily schedules, were assigned to gather data in any of the schools should an assigned researcher be unable to gather data at a critical time.

In the planning, the researchers decided to make every effort to gather data during the beginning, middle, and end of each unit of study which employed the integrated assessment model. When possible, data were gathered during the planning, implementation, and summative evaluation stages of units. Copies of the various data-gathering forms are found in the appendix.

Preliminary Results

By December, 1996, the three case study schools had each completed at least one unit of study using the integrated assessment model. The seven self-reporting schools had completed a total of four units, with one unit incomplete. The researchers met to review preliminary results, based on ten weeks of observations and interviews. During this meeting researchers met in two groups, those working with self-reporting schools and those working with case studies, to synthesize their findings to date. The researchers then shared their preliminary findings with each other and with the research consultant (via telephone conference). The two groups of researchers found that their results were compatible. Following is a summary of those findings to date as they address the two research questions.

Research Question #1: How does the model's usage facilitate student learning in selected grade levels and subject areas?

According to preliminary results, teachers and library media specialists said that the model facilitated student learning in all grade levels studied and for units of any length. The "integrated assignment" stage of the model was reported as a key to enhancing student learning:

1. Students knew what they were doing and were more on task.
2. Students had a sense of participating in the learning process.
3. Students demonstrated pride in the finished product.
4. Student learning is higher quality learning, i.e., teachers and library media specialists's said that students were employing higher level thinking skills.
5. Students were more responsible for their learning, enhancing critical thinking.

6. Students learned that research can be a relatively simple process, like gathering data about book characters.

7. Students asked good questions.

8. The model makes students aware of what's expected of them.

9. The model is an advanced organizer which frees students to pursue the content.

Research Question #2: How does use of the model influence collaborative planning and integrated instruction?

While the integrated assessment model is an assessment of student performance, preliminary results suggested that the model is a useful teaching tool. The model gives teachers and library media specialists a "handle" on information use and how it can be taught as a learning process. The library media specialists found that the integrated assessment model is an effective and efficient planning tool which:

1. Enables the teacher to check the student's pre-knowledge.

2. Moves learning outcomes to the beginning of the project.

3. Makes it easier for a school to tie everyday instruction and assessment to the school improvement plan.

4. Encourages teacher/library media specialist collaboration, enhancing teacher satisfaction by working with other staff members.

5. Apparently works with short (2 day) as well as longer (several week) units.

6. Improves teaching by keeping the teacher focused on outcomes and assessments.

In short, this model appears to be a tool which benefits teachers at least as much as students.

Conclusion

The need for improved assessment of learning, especially the assessment of critical thinking and problem solving, was the stimulus for creating the Interdisciplinary Assessment Model. It is the result of a review of professional literature and of the collective thinking of library media specialists, teachers, school administrators, and university faculty. Creation of the model required an examination of assessment strategies, establishment of a common language for library media specialists to work in various curriculum areas, and a comparison of current state standards for subject areas.

The model was revised, based on reactions of professionals in the field. This revised model is being tested in ten schools in Kansas during the 1996-97 school year. This paper presents preliminary results of data gathered through the mid-point of the study (December, 1996). Data gathered indicate that the model is useful as a planning guide for teachers as well as a learning tool for students.

Collection of additional data during spring semester, 1997, will reveal additional findings which will be compared to these preliminary results. The model revision will occur after the Research Committee analyzes the findings of research when the data-gathering is completed.

References

Eisenberg, M. B., & Berkowitz, R. E. (1990) *Information Problem-Solving*. Norwood, NJ: Ablex.

Kuhlthau, C. C. (1994). *Assessment and the School Library Media Center*. Englewood, CO: Libraries Unlimited.

APPENDIX
KASL Research Committee
Interview Questions for Teachers and Library Media Specialists
10/22/96

Teacher's/library media specialist's name____

Date____________ Researcher____

1. How did students' learning compare to last year's similar unit?

2. To what extent did the model make a difference in this year's unit? Give an example.

   Which part(s) of the model made a difference:
   a. Assignment
   b. Plan of action
   c. Doing the job
   d. Finished product
   e. Evaluation

3. To what extent did the model make a difference when you were planning with the library media specialists? When collaborating with other teachers? When teaching? When working with students independently?

   Which part(s) of the model made a difference:
   a. Assignment
   b. Plan of action
   c. Doing the job
   d. Finished product
   e. Evaluation

4. Was use of the model an effective use of your time?

   Which part(s) of the model were effective:
   a. Assignment
   b. Plan of action
   c. Doing the job
   d. Finished product
   e. Evaluation

5. How do you use the model? Is it a standard part of your teaching?

   Which part(s) of the model do you use:
   a. Assignment
   b. Plan of action
   c. Doing the job
   d. Finished product
   e. Evaluation

6. Do some parts of the model work better than others? Which ones?

    a. Assignment
    b. Plan of action
    c. Doing the job
    d. Finished product
    e. Evaluation

7. How can the model be improved?

    Which part(s) of the model can be improved:
    a. Assignment
    b. Plan of action
    c. Doing the job
    d. Finished product
    e. Evaluation

8. How much time in the school day is allowed for your planning?

9. Did this model help prepare students for state or local assessments administered in the spring?

    Which part(s) of the model helped:
    a. Assignment
    b. Plan of action
    c. Doing the job
    d. Finished product
    e. Evaluation

10. How is the model affecting your school improvement plan?
    Which part(s) of the model are helping:
    a. Assignment
    b. Plan of action
    c. Doing the job
    d. Finished product
    e. Evaluation

11. Other comments:

KASL Research Committee
School Information
10/5/96

Please note: This information is confidential. The name of the school and individuals will not be identified in our study but will be thanked in an acknowledgment statement.

Name of school:____

Person supplying information:__________________________________

Grades:______ Total number of students: _____ Total no. of certified teaching staff:_________
Address: ____

____

Principal's name:________________________ Principal's phone:(___)______________

Library media specialist (LMS):__________________________________

LMS Phone number: (___)_____________ LMS Fax number:____________________

Electronic mail address:_______________________________________

Grade levels with whom you'll work **for this research project:**____________________________

Subject areas with whom you'll work **for this research project:**__________________

Number of paid support staff working in the library media center (FTE): ________________

Number of adult volunteers: ______ Number of student volunteers:__________________

Do you have flexible scheduling? _____________________________________

How would you characterize your school administration's support of the library media program?

Your number of years' experience integrating the teaching of information skills: ____________

Please characterize the role of the library media specialist in instruction **most of the time**: (circle one level)

Level 1 No involvement in instruction: The library media center is bypassed entirely.

Self-help warehouse: Facilities and materials are available for teachers and students to use without help of the library media specialist.

Level 2 Individual reference assistance: The library media specialist (LMS) at times delivers the information directly to the user, but will continually work to help patrons gain the skills they need to find and use information themselves.

Spontaneous interaction and gathering: The LMS responds at a moment's notice with materials, resource people, production activities, or any other activity that capitalizes on the unique teaching moment.

Cursory planning: Informal and brief planning with teachers and students for library media center involvement--usually done in the hall, the teachers' lounge, the lunchroom, etc. (Here's an idea for an activity and new materials to use. Have you seen . . . ? Can I get you a video?)

Level 3 Planned gathering: Gathering of materials is done in advance of class project upon teacher request.

Evangelistic outreach: A concerted effort is made by the LMS to promote the philosophy of the library media center program.

Scheduled planning in the support role: Formal planning is done with a teacher or groups of students to supply materials or activities for a previously planned resource-based teaching unit or project.

Level 4 Instructional design, level 1: The LMS participates in every step of the development, execution, and evaluation of an instructional unit. LMS involvement is considered as enrichment or as supplementary.

Instructional design, level 2: The library media center staff participates in resource based teaching units where the entire unit content depends on the resources and activities of the LMC program.

Curriculum development: Along with other educators, the library media specialist contributes to the planning and structure of what will actually be taught in the school or district.

Adapted from: David V. Loertscher, *Taxonomies of the School Library Media Program* (Englewood, CO: Libraries Unlimited, 1988), 10-14.

Other comments about your school's library media program:

KASL RESEARCH COMMITTEE
Lesson Observation Guide
10/5/96

Name of school:______________________________

Date of observation: ______________ Name of observer: ______________________

Subject or curriculum area:______________________________

STAGE OF MODEL	DESCRIPTION OF ACTIVITIES	OBSERVER'S REACTIONS
1. Assignment		
2. Plan of action		
3. Doing the job		
4. Finished product		
5. Evaluation		

KASL Research Committee
INTERVIEW GUIDE FOR SELF-REPORTING SCHOOLS
10/22/96

Date______________ School_______________________________________

LMS interviewed_________________________ Interviewer_________________________

1.Please describe what you have done with the assessment model since we last talked. If working on a unit, briefly describe the unit with which you're using the model, i.e., subject area, grade level, brief description of the objectives and activities.

2. What parts of the assessment model worked best?

a. Assignment
b. Plan of action
c. Doing the job
d. Finished product
e. Evaluation

3. To what extent were you able to use the model in the planning and/or evaluation of the unit?

Which part(s) of the model did you use:
a. Assignment
b. Plan of action
c. Doing the job
d. Finished product
e. Evaluation

4. What problems did you have using the model?

Did you have problems with:
a. Assignment
b. Plan of action
c. Doing the job
d. Finished product
e. Evaluation

5. How would you change the model so that it would better fit your needs?

Which part(s) of the model would you change:
a. Assignment
b. Plan of action
c. Doing the job
d. Finished product
e. Evaluation

6. What other comments do you have about the model and its use?

7. Set the next appointment for an interview:______________________________________

Author Biographical Notes

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