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

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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**
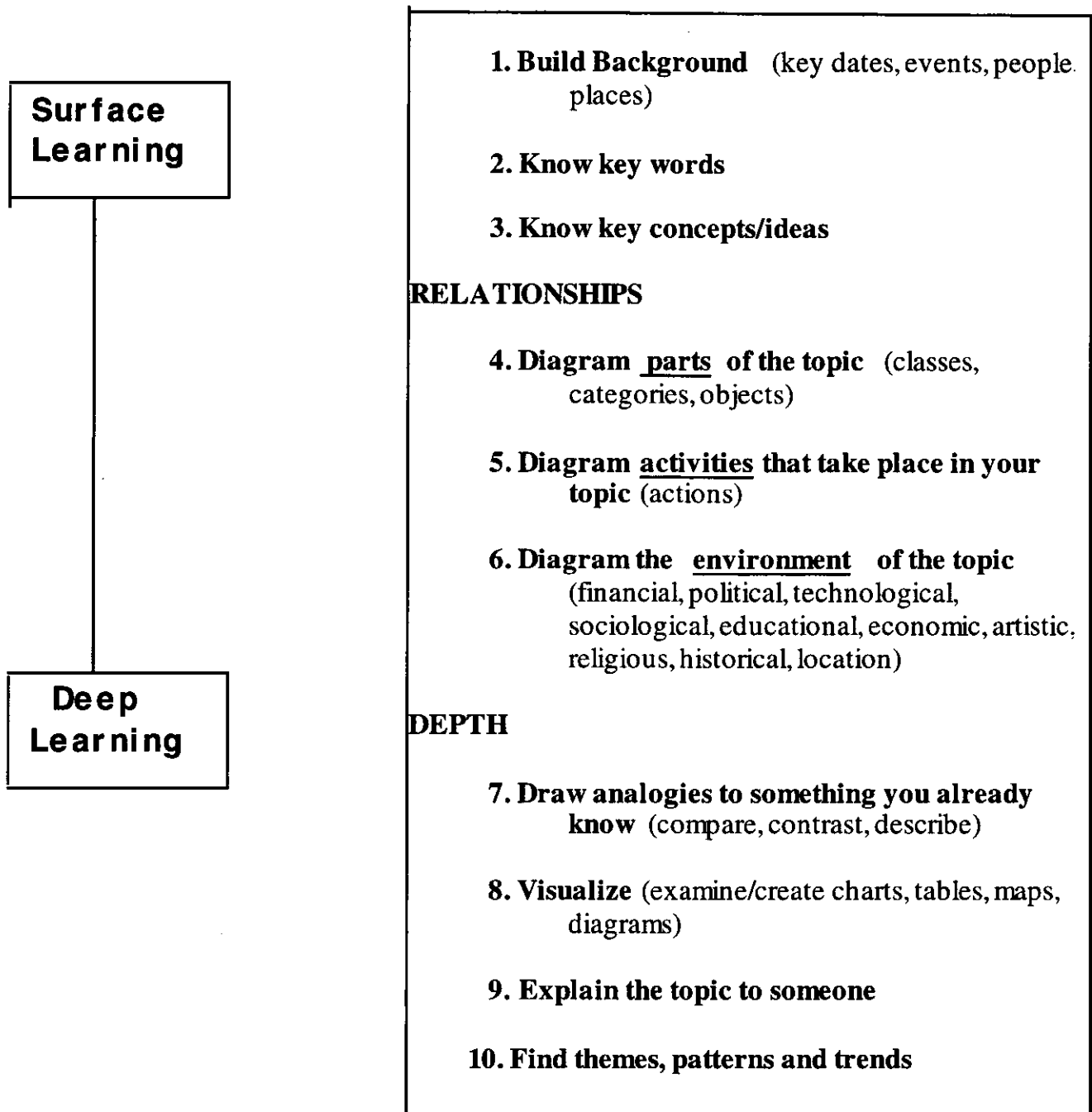
10. **Find themes, patterns and trends**

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."
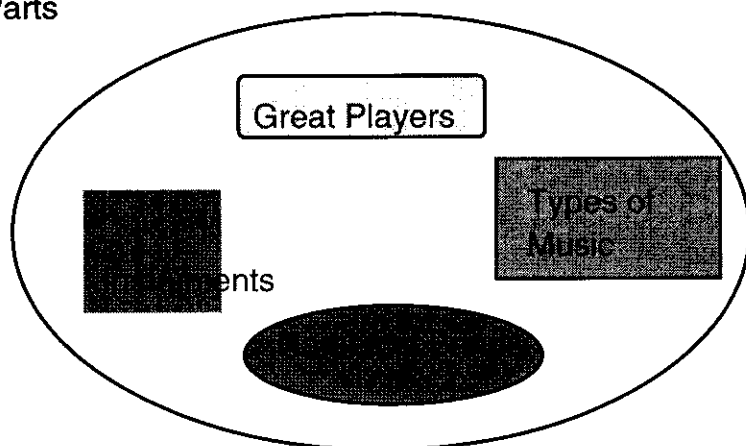
Topic: Bands and Orchestras:
Parts

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:

Topic: Bands and Orchestras:
Activities

Playing/
Practicing
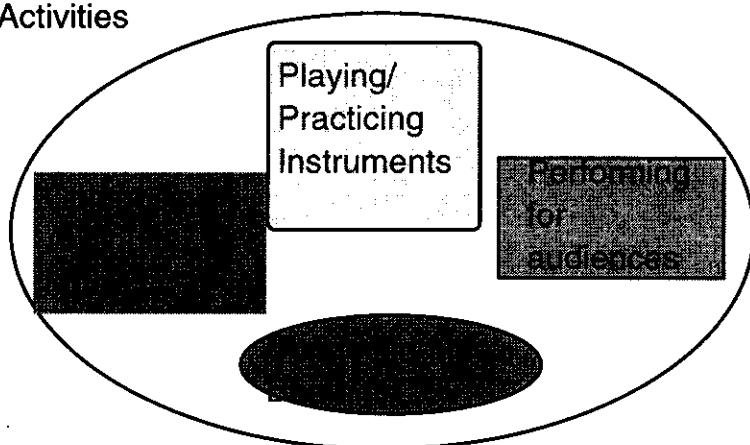Instruments

Performing
for
audiences

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.

Topic: Bands and Orchestras:
Environment

Culture

Other Entertainment

Arts

Performing

Playing/
Practicing
Instruments

Other
Music

Playing
for
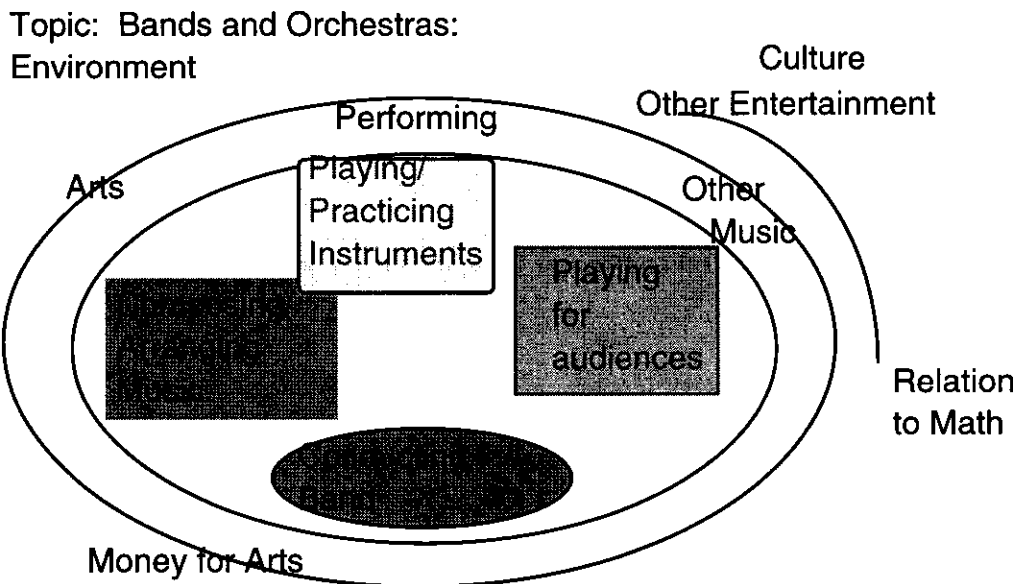audiences

Relation
to Math

Money for 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 <u>slowly but steady</u> will win out <u>over flashy but inconsistent</u>.

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).

<div align="center">

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

</div>

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

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.
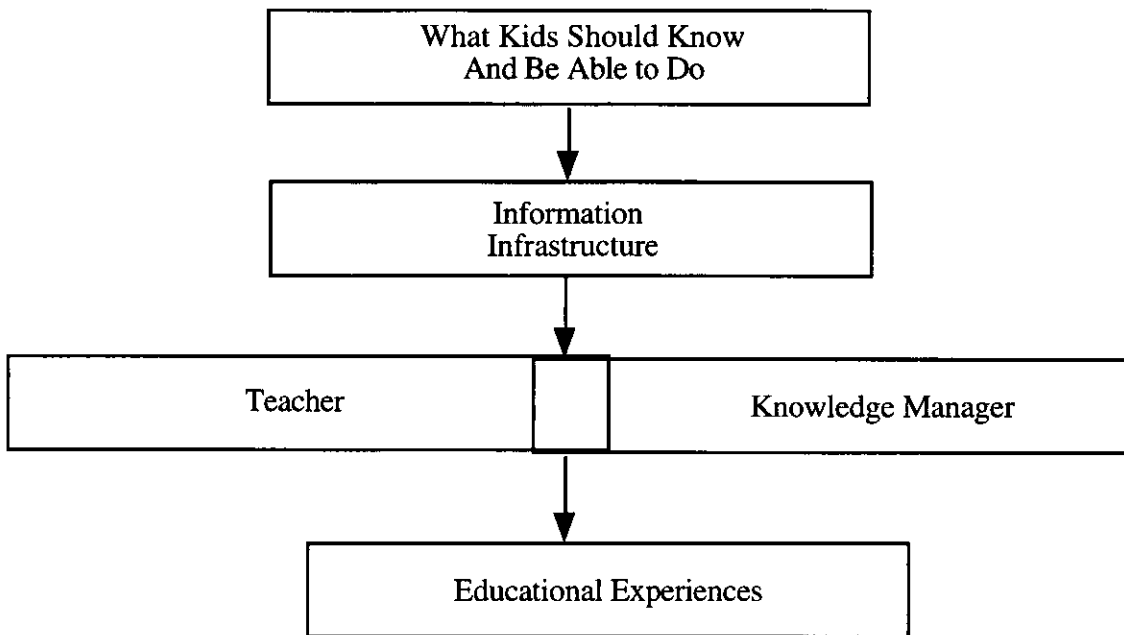
Figure 6: Role of Teachers and Knowledge Managers

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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