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THOUGHT STYLE ANALYSIS: A METHOD FOR ANALYZING  
PATTERNS OF THINKING

by

Margaret Anne Schrader

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A Dissertation Submitted to the Faculty of the  
DIVISION OF EDUCATIONAL FOUNDATIONS AND ADMINISTRATION

In Partial Fulfillment of the Requirements  
For the Degree of

DOCTOR OF PHILOSOPHY

WITH A MAJOR IN FOUNDATIONS OF EDUCATION

In the Graduate College

THE UNIVERSITY OF ARIZONA

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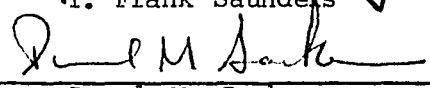
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and recommend that it be accepted as fulfilling the dissertation requirement  
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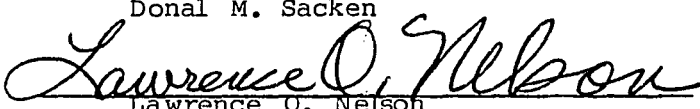
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### ABSTRACT

Increasing demands for improving thinking in all facets of society determined the need for this study. Thinkers must be able to improve the quality of their thinking to succeed in a rapidly changing, highly technological world. This study examined thought style as a way of patterning thought, resulting in different qualities. The purpose of this study was to develop a means for thinkers to recognize and select alternative thought styles, by examining steps in the stylization process.

Most educational programs to improve thinking do not focus on thinkers' thought patterns. A model is necessary to structure components of thinking patterns, and to orchestrate the steps in the examination of the patterns. The Inquiry Cube model developed Dr. T. Frank Saunders was used for this purpose in this study.

The process of collecting and analyzing data about thought patterns described in this study could be implemented by thinkers. Future plans include adapting this design for an expert system to take advantage of computer aided diagnosis.

The Cube model, and the process for analyzing thought patterns described in this study should facilitate collection of information about manifestations of thought style and the development of a computerized system to analyze thought style.

## CHAPTER I

### INTRODUCTION

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"How can man avoid thinking when he is defined in terms of its presence?" (Saunders)

"One aspect of the teaching of thinking is the need to remove certain misconceptions and to undo certain habits. For example, we really do need to stop considering thinking as simply 'intelligence in action'. We do need to think of it as a skill that can be developed by everyone. We do need an awareness of the intelligence trap. We do need to encourage the self-image of 'I am a thinker'" (deBono, 1985, p.163).

### Rationale for Study

Thinking is fundamental as a distinctively human activity. In order to function successfully in a rapidly changing environment people must be able to think effectively. To improve the quality of life, educators must be able to help people improve their thinking. In this society, which values diversity among individuals, thinkers must be able to identify and select different successful ways of thinking.

What do we require to improve thinking? Educational programs addressing thinking have all emphasized improvement of individual thinking skills and processes. A broader approach would be to improve the quality of thinking. The quality of thinking could be distinguished by its effectiveness and not just its efficiency, i.e., a result of

how thinkers arrange thinking patterns, or "thought styles." People could be more successful thinkers if they recognized competing thought patterns or styles from which they could choose (Saunders ; Papert, 1980). A thought pattern is the way a thinker develops an idea in some context. A style refers to the sequence of levels of abstraction typical of a given thinker.

To improve, or change the quality of thinking, requires that a person change thought style. To be able to change a thought style, to select a thinking pattern deliberately, or to begin at a different level of abstraction for the pattern, first requires describing the pattern carefully. A technique for describing thinking patterns has not been readily available.

Analysis of thought styles would permit the description of thought patterns and provide answers to such questions as: (1) What abstraction steps do people use in the thinking process? (2) How are the steps identified? (3) What are the relationships or connections between the steps? (4) What is the sequence of these steps? (5) How do the steps used and the sequential relationships of the steps vary depending upon the purposes of the thought pattern in some context? (6) Are some steps or sequences of steps used habitually? (7) What patterns of thinking are most appropriate for

different contexts? (8) What qualities of thought result from stylizing different patterns of thinking?

For the purposes of this study, thought style described thinking patterns by identifying the components of thinking patterns and how thinkers put the components together. Here, analysis of thought style enables the writer to identify thought patterns, recognize different thought styles, and evaluate thought styles used to meet different purposes. This analytic process enables people to select an appropriate thought style in any context, making thinking pattern selection a deliberate process.

Thought style analysis is necessary for people to identify, and deliberately select, alternative thinking styles. A method for analyzing thought style has not been completely explored. Thinkers need an easy to use form for thought style analysis. This study describes the development of a model for thought style and a method for analyzing thought patterns.

### **Background Significance and Need for the Study**

Studies of thinking selected from the literature form the background for this study of thought style. Thinking is basic to all human experience. The need for improvement of thinking is a significant issue in all fields. Educators need to be able to help thinkers improve thinking in order

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to function successfully in a changing world. There are many examples of contexts in which improving thinking is a major concern.

In the business world, workers may need to make many career changes during their lives. Workers will need to choose new jobs and learn new skills at an expanding rate. The knowledge of specific skills will no longer be as valuable as the ability to learn and adapt to new situations. People will have to learn to learn. Former Labor Secretary William Brock suggested that " . . . education that teaches thinking rather than manual skills will best prepare individuals to deal with this change" (1987). Learning patterns and styles of thinking is transportable to different contexts, as opposed to the static character of learning data or manual skills.

Increased rate of technological changes will require users of the new technologies to change their thinking patterns and style of working in order to adapt to new tools (Dede, 1989). Thinking tasks involving decision making and problem solving are already done by computers. For continued improvement in machine intelligence variables, even those of which we may not be aware, thought processes must be identified and modeled (Schank, 1984).

Arizona's official Thinking Skills Specialist, suggests that solutions to substance abuse problems may be found in

improving the critical thinking skills of high risk students (Lennan, 1989).

These examples suggest just a few of the reasons society has challenged educators to develop methods for improving thinking. Critics claim that schools have failed to help students learn about "the structure and ways of thinking . . . resulting in students who can regurgitate facts but not solve problems adequately" (Goodlad, 1984). Currently, schools are emphasizing the need to teach thinking skills to students, yet many teachers do not know how to teach thinking (Sternberg, 1987). How do educators meet the demand for improving thinking? What goals should be set for thinking programs?

Historically, there have been many educational approaches to improve thinking. Programs designed to "teach" thinking are often predicated on notions of different "types" of thinking, such as "lateral thinking" (deBono, 1970), "creative thinking" (Perkins, 1985), "critical thinking" (Ennis, 1985), and "power thinking" (Marzano, 1986). These different ways of describing thinking have resulted in a variety of educational goals, programs, and essential components of thinking. There is no general agreement about **WHAT** are the essential components of thinking that must be taught, in large part because no integrating framework for the generic components of thinking

that is inclusive of the various disciplines that study thinking is widely used (Quellmalz, 1987; Sarason, 1979; Ware, 1985).

Lack of agreement about essential thinking components is not the only problem. Programs frequently emphasize the development of specific skills, without focusing on how a thinker selects such skills or on the patterns of relationships of such skills. A better thinker is not just a person who can respond faster or use a specific thinking skill or strategy in a given context, but someone who can also deliberately select and use thinking skills and patterns, in different contexts, for different purposes. "Competence in thinking is not what one thinks about, but how one thinks and can exhibit the process for another's intelligent future" (Saunders, 1970, p.199).

A broader view of improving thinking would emphasize improving the quality of thinking (Schlessman-Frost, 1985), rather than just individual skills. The quality of one's thinking is often identified with such terms as curious, impetuous, dull, creative, digital, or distracted. But what do these terms mean? What thinking processes do people use that observers would label with these terms? What thinking activities operate during these processes? How can we identify "how to think" such that these specific qualities will result? How can we identify the quality of thinking

such that a valued style of thinking can be selected or rejected for any given context?

The quality of thought is a result of how a pattern of thinking is structured. We must be able to describe this pattern before we can change our thinking or improve the resulting quality of thought. "To make thinking a deliberate process, easily described is to allow a means of changing our thinking" (Decker, 1972, p.158). How do we describe thinking?

Davis and Saunders (1973) described thinking as an aesthetic process and examined how thinkers structure thought or the "model" used for thinking. Davis and Saunders' approach to improve thinking utilized a concept of thought style that emphasized orchestrating patterns of thinking. They defined style as "the arranging and combining of elements by directing certain relating qualities" and suggested that style could be identified as "the process or activity of choosing elements and deliberately directing their relationships" (Davis and Saunders, 1973, p.12). They presented this idea of style as a model for identification and construction of thought styles, or alternative thought patterns.

In their discussion of possibilities for diagnosing thought style, Davis and Saunders suggested using computer techniques to plot patterns. For thinkers, educators, or

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computer programs to identify thought style it is necessary for someone to develop a system for thought style identification. To identify or construct a thought style it is necessary to be able to analyze a thought style to determine the essential elements, and how to combine the elements. Thought style analysis requires a system to formalize the description of the thought patterns.

This study addressed the problem of analyzing thought style by developing a system for thought style analysis. This system is a working model which can adapted to develop computer programs to identify thought patterns. To be most effective this system must be comprehensive enough to include a framework of thinking components as defined by experts. It also must provide a form for tracking and analyzing thought styles as alternative patterns among the components.

Examination of thinking patterns is not possible without a structure to organize the components of thinking. To orchestrate (or compare) comprehensive information from various experts on thinking, this researcher required a framework to (1) organize the components of thinking, including the experts' definitions of thinking, (2) provide relationships among the components of thinking, and (3) explain patterns formed by the relationships.

Davis and Saunders (1973) used one aspect of the Inquiry Cube model (Saunders, 1969) as a framework to integrate and organize components of thinking (Davis and Saunders, 1973). To simplify the problem, this study also used only one facet of the Cube to organize thinking components, as well as to systematize the process of thought style analysis.

The theory of thought style as a construct of thought patterning, was adopted for this study as a way to describe thinking. "The importance of describing a process carefully is to be found in the principle that whatever can be described can be taught" (Saunders, 1970, p. 199). This view of enabling learners is in keeping with Papert's vision of "the child as an epistemologist, where the child is encouraged to become expert in recognizing and choosing among varying styles of thought." (Papert, 1980, p.98). This study examines a process for recognizing and selecting styles.

### **Statement of the Purpose**

The primary purpose of this study was to design a method for analysis of thought styles as a system for structuring thought patterns. To complete the purpose of this study it was necessary to: (1) define and organize the

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categories and variables of thought style, (2) present a generic model through which to process the categories and variables of thinking, (3) describe a form for analyzing thought style that can be adapted for use by computers, and (4) explain how to use the analysis to modify or select alternative thought styles such that thought stylization becomes deliberate.

### Assumptions

This study made the following assumptions:

1. Thought styles can be identified and analyzed.
  2. Thinking can be improved by changing thought style. Learning alternative thought styles and developing the flexibility to change thought styles is possible, and will increase thinkers' options, and potentially their success at thinking tasks.
  3. A procedure for analysis of thought styles, which can be easily used in many contexts, can be developed using an integrating model for the categories and variables of thinking.
  5. A system for thought style analysis can be developed as a model for developing a computer based expert system.
  6. The model used for developing a system for thought style analysis will determine the categories and patterns of thinking analyzed.
-

7. Conflicting values may affect the selection of thought style or type of analysis.

### Limitations

Some of the limitations of this study were as follows:

1. The inclusion of a specific model to develop a system for thought style analysis necessarily precluded the use of other models. Any limitations in the model would be limitations in the study.
2. Most literature on thought is about specific skill development rather than "style." Most literature about style in thinking refers to a specific skill area, rather than to an integrated approach to all components involved in thinking. There is not much information available about an approach to thought style analysis which looks at more than one element of thinking, or patterns of thinking. The lack of relevant sources for background research may be considered a limitation.
3. This study described the development of the procedure of thought style analysis in terms of generic usefulness. It did not develop specific applications to be tested on subjects. The model and the procedure require testing.

### Definitions of Terms

**Analysis:** To break into parts or variables.

As analytic, dealing with the components of a larger composite.

As opposed to critical or speculative.

An orientation in which the words and concepts must be empirical and denotative.

(Saunders)

**Category:** A group of items having specific properties as defined by criteria from a particular subject or universe of discourse.

**Conceptual Style:** The sequence and emphasis used by a person to identify, explore, and make judgments about meanings, relations (Saunders)

**Connectives:** Words that signal relationships.

**Data:** "Things produced by or resulting from the activities of the system." (Engle, et.al., 1981, p.29)

**Expert System:** A computer system that makes decisions from facts and rules in a specific area of expertise. The system consists of a knowledge base, which is a collection of facts (short-term information that can change) and rules (longer term information about generating new facts and hypotheses), and an "inference engine" (the system's method of reasoning). The system

asks questions, draws inferences from the knowledge base, and reaches conclusions. Further, the system should be able to explain its train of reasoning and give users relevant advice. (Forsyth, 1985; Negoita, 1985)

**Hypotheses:** Informing rules to direct and determine the structure of the inquiry. Hypotheses are "instruments to construct the system" (Saunders, 1988). They have their own evaluative criteria of adequacy. (Saunders)

**Method:** A pattern, procedure, or order for acting.

**Model:** A framework for organizing ideas that determines the relationships among the ideas, giving the ideas meaning.

**Pattern:** A defined relationship between elements of a structure.

**Plan:** Reduced randomness (Saunders).

**Relationships:** How things are connected or interrelated.

**Structure:** The way parts are arranged and organized.  
How the categories or elements interrelate into a complete system.

**Syntax:** The structural relationships that exist between ideas. The directing of ideas by relating terms.

**System:** A group of related elements that work toward a common goal (Mandell, 1987). Or, an hypothetical way of orchestrating common elements.

**Style:** "A system for structuring . . . Style is found in the way relationships are established and the way these relationships prescribe qualities" (Davis and Saunders, 1973).

" . . . The habituation to, and operational diagnosis of certain combinational patterns" (Saunders, 1969).  
The sequence of levels and categorized variables used by a thinker.

"Style is a replication of patterning, whether in human behavior or in the artifacts produced by human behavior, that results from a series of choices made within some set of constraints" (Meyer, 1987, p.21).

**Thinking:** Using a purpose to select a context (among meanings) through which to combine elements toward that intended purpose.

Thinking is placing a datum in a context for a purpose.  
A person's thinking is selecting some bit of information for a usual context for a characteristic reason.

(Saunders)

**Thought:** The result of thinking acts. An action from a determinate plan.

**Thought style:** "Prescribes the ordering in the judgment process" (Davis and Saunders 1973).

One of many level sequences in search of meaning.

**Thought Style Analysis:** The system for explaining the stylistic variations of how thinkers structure and level thinking.

**Values:** Future plans which establish the purposes for the content and structure of activities.

A judgment base; selective system.

The directive for choice and planning,

### Summary

The need for improvement of thinking has been identified. This study used a concept of improving thinking that emphasizes identification and deliberate selection of different thought styles. To help thinkers improve thinking by changing thought style, educators need a method of thought style analysis to examine thinking patterns and stylistic variations in thinking. This study developed a form for analyzing thought style. This form provides the basis for future computer aided analysis.

This chapter provided an overview of why this study is needed. Chapter II discusses the theoretical basis and rules for this study. Chapter III reviews literature about thinking and thought style. Chapter IV presents forms and a procedure for tracking thinking patterns to identify thought

style. Chapter V suggests future implications for thought style analysis.

## CHAPTER II

### METHOD

..."The cube becomes the instrument by which we diagnose the judgment process-- from now on referred to as the thinking style -- of the individual and the instrument which we use to change and refine thinking style; i.e., the cube of inquiry becomes our teaching instrument" (Saunders, 1969a).

Chapter I identified as a problem that current efforts to improve thinking have emphasized improvement of isolated skills, with little concern for the improvement of the quality of thinking. Different qualities of thinking result from different patterns established by relationships among thinking skills and processes. Thought style is the system that thinkers use to structure their patterns of thinking. This paper presents a way to examine how thinkers structure thought.

The overarching methodological problem of this study was to design a comprehensive system for thought style analysis. This system makes the identification, deliberate selection, and replication of thinking patterns apparent, using a framework that structures the relationships among

the components of thinking. An applications problem was to produce forms that educators could use in multiple contexts to record and organize information about manifestations of thought style. The futures problem was to determine what questions must be included in these forms such that answers would enable a computer based expert system to diagnose a thought style.

The assumptions that formed the basis for this study were discussed in the previous chapter. The purposes of this chapter are to:

Examine the Inquiry Cube as the model used to construct the theory of thought style.

Select those categories or components of the Cube that are most directly relevant to the purposes of this study.

Examine the theoretical basis for this study.

Discuss the use of the Inquiry Cube as it directs the process of thought style analysis.

Propose rules for a system of thought style analysis.

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### Inquiry Cube

To develop a system of thought style analysis, the models and theories behind it must be identifiable. Theory cannot be meaningful without a structure for the system, rules that assign content meaning to the system, and a well-defined model to supply the relational properties. A system for thought style analysis will be only as effective as the integrity of the design of the model used to construct the theory. The model used to construct the theory will affect the variables, categories, language, definition types, rules, and relationships among categories.

The model used must adhere to the following rules for models as derived from Engle, Saunders, and Blake (1981).

Since the analysis of thought can only consider variables in the model, the content of the model must consist of variables and categories that are necessary, sufficient, and mutually<sup>4</sup> exclusive. Categories must be exhaustively explored and determinate.

The structure of the model must consist of the fewest number of categories and make the fewest number of assumptions to explain the most categories

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appropriately (parsimony). Rules for the relationship of the necessary components must be specified. The parts must be internally consistent, or agree with the whole model, i.e., methodologically reducible.

The model should define and legislate relationships among the categories and variables.

The theory of thought style used in this paper relies on the Inquiry Cube model developed by T.Frank Saunders. This model was used to organize the categories and variables of thinking, to orchestrate the relationship of the components, and to provide a means for deliberate choosing of patterns in the selection of components (Saunders 1969a). The "Inquiry Cube" model can be viewed as a three dimensional array with standard X-Y-Z axes. This structure allows sequentially generic levels, depths, and views of the Cube. The lowest level of the Cube consists of the "contents" of the inquiry. The second level, which is generic to the first, consists of the "context" in which to place the contents of the inquiry. The third level, which is inclusive of the first and second levels, includes the "purposes" by which to select the context for inquiry (Figure 1).

PURPOSE

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CONTEXT

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CONTENT

Figure 1. Levels of Saunders' Inquiry Cube

Thinkers can explore each of these levels at different depths. The first depth is the "context" within which the inquiry takes place. The second depth is the "language" with which that context may be discussed and which attaches meaning to referents in the first depth. The third depth consists of the "value bases" behind the language system selected for the contextualization of the discussion (Figure 2).

PURPOSE			
CONTEXT			
CONTENT			
	CONTEXT	LANGUAGE	VALUE BASES

Figure 2. Depths of Saunders' Inquiry Cube

The levels and depths of the Cube provide a two-dimensional, nine-square matrix for organizing the levels and depths of thinking. This describes one view of the Cube. In Doublethink, Saunders suggests that the style question can be asked "from two views in terms of the Cube: content and form" (Saunders, 1973, p.179; Saunders, 1970). This requires rotation of the squares to change from the content to the form view (Figure 3).

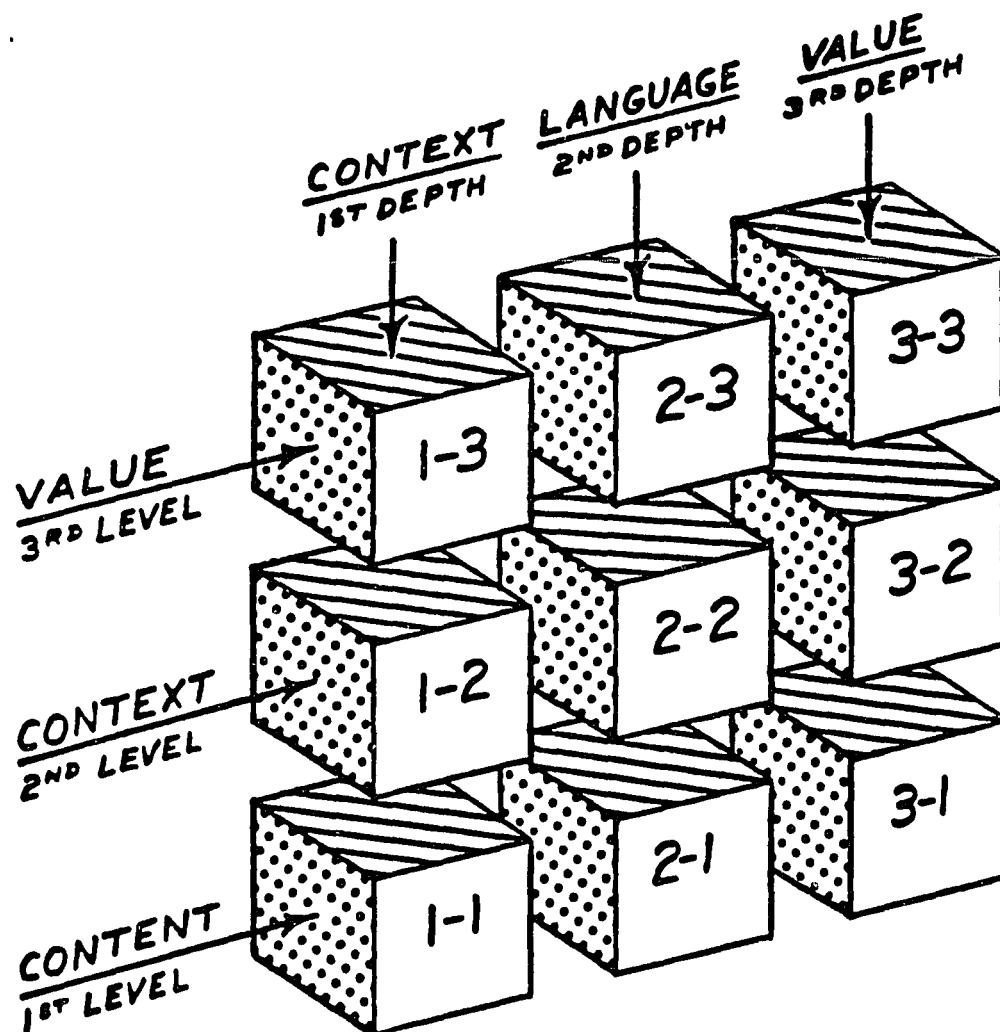


Figure 3. Form View of Saunders' Inquiry Cube

(Decker and Saunders, 1973, p.178)

Davis and Saunders (1973) described a three dimensional view of the Cube. The first depth, "theory," is directed by the second structural depth, "form," which is directed by the third structural depth, "quality" (Figure 4).

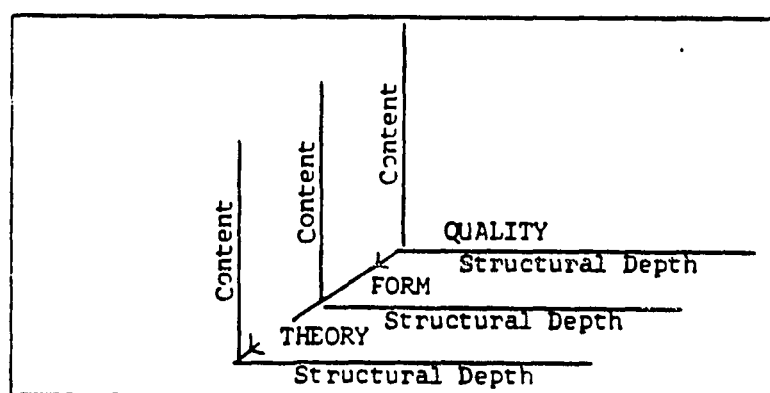


Figure 4. Qualitative Dimension of Saunders' Inquiry Cube  
(Davis and Saunders, 1973, p.87)

Consideration of a three dimensional Cube suggests that the structure of thought can be described in terms of twenty-seven units of the Cube (Figure 5).

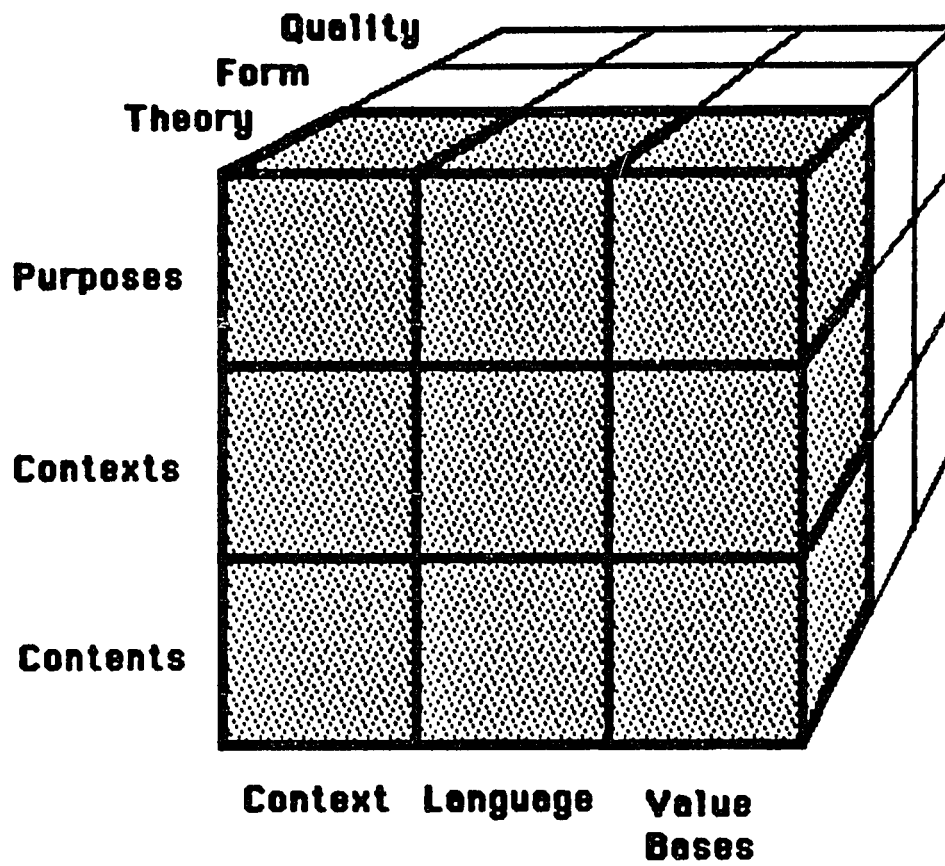


Figure 5.

SAUNDERS' INQUIRY CUBE

Davis and Saunders (1973) discussed the two dimensions of the Cube, level and depth, at one structural depth of the Cube, identifying thought style as how the thinker uses nine units of various content and structural combinations. This study also examined only these first nine units, as shaded in Figure 5.

### Thought Style

No previous studies have completely investigated thought style analysis, as a method of analyzing patterns among the components of thinking. There are no competing models to examine, compare, and select.

The theoretical basis for this study can be found in the works of Saunders (1969), Davis and Saunders (1973), and Saunders and Decker (1973). Davis and Saunders, in Thought Stylization: A Pattern for Thinking, defined thought style as a "system that prescribes the ordering in the judgment process." They used the Inquiry Cube to explain the structure of thought. Described in terms of this model, style has the procedural categories of:

- (1) sequence, or order through the levels and depth of the Cube;
- (2) intensity, that is the confrontation and selection or rejection of alternatives at any level or depth;
- and,

(3) duration, or time spent at any given level or depth.

These categories are arranged according to different priorities, in different combinations based on the variation, repetition, and contrast in the action pattern of the categories.

Davis states that:

"Describable components of style should be identified in terms of the content of the stylization process. The combination of the various components in alternate ways should result in alternate kinds of style." (Davis, 1972, p.52)

In Doublethink, Saunders (1976) presented a series of activities for diagnosing types of thinking styles. The book provided specific activities for thinkers to identify their "level" of response in terms of the sequence of levels in the Inquiry Cube.

Although these authors developed a model for thought style identification, and used activities for identifying "levels" of thinking according to this model, they did not answer the following questions, which this study has addressed:

1. How are the describable components of thought style identified? How does terminology about thinking
-

activities, and relationships among activities, correspond to the locations and structure of the Cube?

2. What is a procedure for examining the arrangements of style categories and the resulting patterns?

3. How can we analyze thought patterns adequately to describe the variety of styles possible during any thinking task?

4. How can the concept of thought style be useful for choosing and prescribing styles, as well as for identifying styles?

5. How can the thought pattern used during a thinking task be distinguished from, or identified as, an individual's habitual thought style?

Analysis of thought style poses questions about manifestations of thought style during thinking activities. For the purposes of this study, these questions include:

What are the components of style? Answers should quantify, or measure, various parameters of thought style. These parameters include the duration at any

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given location, level or depth, the frequency or repetition of locations, relationships, or patterns, and the number of alternatives explored.

How are the components put together? Answers explain the syntax of the pattern. Syntactic rules establish sets of possible relationships by legislating acceptable sequences, combinations, and functions of the components.

Why are the components selected and put together in a certain way? How are the resulting combinations of components used? Answers must explain the elements of style in the context in which they were generated. Examining patterns in different contexts provides a profile of pattern usage, or the "pattern of the patterns" used by a thinker.

### The Inquiry Cube as the Model that Directs Thought Style Analysis

Analysis of thought style requires that the components of thinking can be identified and placed in a framework, or model. Within this model, relationships between the components, relationships of the components to a complete pattern, and variations in patterns can be explained. In addition,

"any design, which attempts to include the diversity of judgment types in problem solving, must be so fundamental that there would be no case of judgment making which is not classifiable or diagnosable by means of that design or model" (Saunders, 1969).

The model must be comprehensive enough to explain thought style meaningfully to any universe of discourse that discusses thinking. To meet these criteria, this paper used part of the Inquiry Cube to:

1. Organize the contents of analysis.
2. Direct the structure of analysis.
3. Monitor the use of analysis.

#### Content of Thought Style Analysis

The content of thought style analysis is information about the categories and variables of thought style and the tool used to collect and analyze the information. The tool must be useful for changing data about components of style during thinking events into information about style. This study organized this information about style according to the content, form, and use of a thinker's thought style.

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### Content of Thought Style

The content of thought style is "what" the thinker orders in thought patterns, identified as thinking acts. As mentioned in the previous chapter, there is not a widely accepted framework that organizes the essential components of thinking, or thinking acts. Research for Chapter III provided thinking components from experts on thinking to be sorted and organized in Chapter IV according to the locations in the Cube. What follows is a simplified explanation of what the locations of the Cube used in this study represent.

The levels and depths of the Cube provide nine locations. A numbering system representing the locations is shown in Figure 6.

1-3	2-3	3-3
1-2	2-2	3-2
1-1	2-1	3-1

Figure 6. Numbering System for Content View of Cube  
(Decker and Saunders, p.169)

The following list describes the contents of each of the locations:

- 1-1 Holds the content of a thought (content)
  - 1-2 Places the content in different contexts (context)
  - 1-3 States the goals by which to select the context (goal)
  - 2-1 Provides definitions for the terms used (definitions)
  - 2-2 Specifies the rules for the categories of analysis of the contexts (rules)
  - 2-3 Uses values to question the language of the goals (values)
  - 3-1 States ontological assertions about the topic (assumptions)
  - 3-2 Coordinates the assumptions of 3-1 with the history of the knowledge and values behind the topic (history)
  - 3-3 Allows judgment of any topic based on the sum total of the previous locations (legislated action)
- (Saunders, 1969a; Saunders and Decker, 1973)

Observations about thinking actions become data, analyzed by specifying which of the Cube's locations the actions represent.

## Form of Thought Style

The form of thought style is "how" the thinker structures the pattern. The Cube directs relationships and determines the patterns among the components of thought style.

"For the proposed concept of style the idea is that style is found in the way relationships are established and the way these relationships prescribe qualities" (Davis, 1972, p.49).

The system the thinker uses to structure thought constitutes a chosen model. Which model is used establishes the rules for the relationships, or syntax. As a taxonomic model, the Cube can be used to explain any relationship among components of thinking in a determinately locatable sequence. The relational structure of Cube allows:

Any location, level, or depth to be related to any other location, level, or depth.

Alternative starting points and end points in the pattern.

Movement in any direction.

Any length pattern.

The way a thinker structures a pattern can be profiled by gathering information about:

The types of relationships established as transitions between locations in the Cube.

The sequence or order of the locations and the relationships. Differential ordering of the elements will result in patterns that have different qualities. For example, a thinker who starts a thought process by examining data and ends with stating a goal exhibits a different quality than someone who first states a goal to direct data collection.

The direction of progress, and gradient of the progression through the Cube, determined by the starting and ending points of the combinations in the pattern, and the total pattern.

The magnitude of the transitional steps in the pattern, and of the total pattern.

The tempo of the pattern, which can be examined by considering the duration at each of the elements and the total time of the thought.

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The intensity of different components of the pattern, determined by the number of alternatives the thinker explored at each location or within each type of relationship.

### Use of Thought Style

"How relationships are established, how they are habitually sequenced by a thinker, and the availability of some options in these sequences are all determined by the use of some basic model, which describes and articulates the different relational categories employed. The model employed is the Cube of Inquiry model" (Decker, 1972, p.153).

How does a person use thought style? How could a thinker use the Cube to direct thought style? There are several approaches possible:

1. The thinker is not aware of style.
  2. The thinker is aware of thought style, and alternative thought styles, but considers it a fixed, unchangeable feature of thinking. The thinker has the "right" way of thinking.
  3. The thinker is aware of thought style and the possibilities of selecting and changing thought styles. The thinker values deliberate selection of thought styles depending on context and purpose of task.
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To answer questions about use of thought style requires looking at the "pattern of the patterns" thinkers use. A single activity provides information about the structure a thinker uses in only one context. This system for structuring a thought pattern is a subsystem of a larger system which is a person's habitual use of style. To explain how a thinker uses thought style, or to recognize a thinker's typical thought style, an analyst must describe the thought patterns thinkers use in different contexts, for different purposes.

#### Structure of Thought Style Analysis

The structure of thought style analysis is the form the analytic process takes. The form determines how we perceive information about thought style. Procedural rules should specify how to mediate the data to inform the process of analysis. The procedure of thought style analysis consists of three parts:

1. Gathering and coding information about thinking patterns.
  2. Analyzing the patterns within the framework of categories and variables of thought style.
  3. Diagnosing thought style.
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## Gathering and Coding Information

Analysis begins with examining the components of patterns. The process changes observations about thinking activities to information about the components of the thinking pattern, the system for structuring the pattern, and the use of the pattern. Analysts codify observations on record-keeping forms to track the starting and stopping points of the pattern, the locations of the Cube used, the types of relationships connecting the locations, the duration at locations, and the sequences of the locations and the relationships in a pattern. Analysts can gather information during any thinking activity in any context, for any purpose. (Record-keeping forms are in Chapter IV.)

## Analyzing the Pattern

Thought style analysis requires assessing information about the components of thinking patterns within the framework of the categories and variables of thought style. Analysis must explain variation, repetition and contrast in the combination and priority of the sequence, intensity, and duration of locations and relationships in the thought pattern. Forms including the questions to ask for analyzing a thought pattern and identifying habitual thought styles, are in chapter IV.

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## Diagnosing Thought Style

The initial steps of the analysis process provide a profile of a style by examining manifestations, or components, of style and explaining the arrangement of the components. The process of diagnosis identifies a style by examining these manifestations to evaluate how closely a style matches, or is differentiated from, other identified styles. Diagnosing habitual thought styles requires comparing thought styles used for different purposes in different contexts to determine how, or if, the thinker legislates the components and patterns used.

### Use of Thought Style Analysis

The Inquiry Cube, as a model for models, is generic to alternative model types. Using this model, it should be possible to structure an analysis that can be used to:

1. Describe thought style.
2. Choose thought style.
3. Prescribe thought style.

### Description

The lowest level use of thought style analysis is to describe style. This may be thought of as history of the thought style: Describe thinkers' activities in terms of the elements of thinking and the pattern of the elements, by tracking a thinking pattern, to provide a profile of the style.

### Choice

Style is only relevant if there is a choice. A thinker can recognize style in the context of multiple style options. Analysis enables a thinker to select a thought style deliberately according to the varying contexts and purposes of thinking activities. The thinker can reinstitute thought patterns by matching profiles, or plan and create styles by orchestrating the pattern of thinking.

### Prescription

The optimal thought style for any given context or purpose is a valued goal thought style. Thinkers can select thought styles to correspond to the goal style, which becomes the target thought style. Prescriptions for style provide thinkers with clear descriptions of what thinking activities to use and how to structure those activities.

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### Rules for Thought Style Analysis

Each of the previous sections suggested rules for different aspects of analysis. Rules were necessary to establish the criteria to determine if the system developed by this study accomplished its goals. The following is a summary of the rules for this system:

Part of the tool for thought style analysis consists of record-keeping forms for gathering data. This data must include:

Thinking activities coded by locations used in the Cube.

Relationships and activities between locations.

Duration at locations and between locations.

Sequence of locations and relationships.

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Number of alternatives explored at each location and relationship.

Contexts and purposes for use of the pattern.

The analysis must include procedures for:

Recording and interpreting data for any thinking task.

Interpreting the data in the context of thought style.  
Analyzing the data in terms of the different possible arrangements of sequence, intensity, and duration of the components of the pattern.

Evaluating the thought style in comparison to target thought styles.

Presenting results that can be accumulated over time to determine thought style in different contexts.

Identifying the pattern of patterns used habitually by the thinker.

Explaining alternative thought styles.

A design for thought style analysis should be useful for:

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Describing patterns of thinking to enable the user to identify their own thought style and the styles of others.

Deliberately selecting and reinstituting thought styles.

Prescribing the styles needed for different tasks by matching optimal styles.

Adaptation to a computer based expert system that consists of questions that an expert would ask to identify thought style, and that require answers in a form that can be analyzed by a computer.

### Hypotheses

Hypotheses test for relationships between two or more variables. This study used the "Inquiry Cube" as a comprehensive model to provide informing hypotheses to direct the structure of the study, to establish procedures to achieve this study's purpose, to legislate what constitutes appropriate data, and to orchestrate the data.

The hypotheses for this study suggest that current views of thinking do not have integrating models and are inadequate in terms of providing a generic analysis of

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style. This study was undertaken to provide a method for analysis of thought styles by describing strategies for sequential progression through the levels and depths of a model which includes hierarchical levels of the major categories and variables associated with thinking.

### Procedures

This study: (1) reviewed literature associated with thinking and thought styles to identify components of thinking as identified by experts in thinking, (2) used the "Inquiry Cube," to organize and relate components of thinking, (3) developed a system of thought style analysis which identifies patterns of thinking in terms of the sequential progression through the levels and depths of the Inquiry Cube, (4) designed a form to record components of thinking patterns, (5) explained strategies for using the process to describe, select, and prescribe thought styles.

### Summary

In reviewing literature about thought style, this writer found no comprehensive procedure for analysis. Previous work has provided a model to explain thought style. This study examined the use of this model to develop a tool and procedure for analyzing thought patterns

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representing different styles. This chapter explained the rules for analysis.

### CHAPTER III

#### LITERATURE REVIEW

There are one-story intellects, two-story intellects, and three-story intellects with skylights. All fact collectors who have no aim beyond their facts are one-story men. Two-story men compare, reason, generalize, using the labor of fact collectors as their own. Three-story men idealize, imagine, predict- their best illumination comes from above the skylight.  
(Oliver Wendell Holmes)

The purpose of this chapter is to review literature related to thinking and thought style, to inform the content of the model used to examine thought style. The search of the literature has focused on: (1) defining thinking and essential components of thinking, (2) style of thinking as individual differences in thinking, and (3) thought style as patterns of thinking.

This chapter presents alternative viewpoints on thinking, ranging from those authors whose ideas of thinking do not include discussions of style, to those authors who consider style of thinking, and finally to authors whose consideration of thought style most closely approximates the viewpoint of this study.

The results of this review will be used to: (1) identify the essential components of thinking to sort into the Inquiry Cube, (2) identify parameters of thinking that

may affect relationships among the components of a thought pattern, and to (3) recapitulate what will be incorporated from previous studies of thought style into this study of thought style analysis.

### Views of Thinking

This study had to identify and organize components of thinking in a framework that demonstrates relationships, and patterns among relationships, of the components. This study surveyed literature by experts who study thinking to determine the essential elements of thinking to organize in the framework.

What is thinking? Definitions of thinking describe it as the "most fundamental expression of intelligence" (Baron, 1985) involving processing information (Costa, 1985) and symbol manipulation (Belth, 1977; George, 1970). Some authors consider thinking as a term synonymous with reasoning (Ennis, 1985; Phye, 1986). Belth discusses the act of thinking as:

"following out and examining at the same time, a path, pattern, mapping, form, or formula until what has been called for in that map, path, pattern, form or formula has been concluded and the whole of it has been considered for its inner and outer consistencies and its warrantable circumstances . . . an act that includes reflection upon itself . . . " (Belth, 1977, p. xvii).

Dewey describes thinking as:

"inquiry, investigation, turning over, proving or delving into, so as to find something new or to see what is already known in a different light. In short, it is questioning" (Dewey, 1933, p.265).

Dewey distinguished the type of "thought" that is stream of consciousness thinking, thinking about things not directly seen or perceived, or thinking as believing from "reflective thinking" which:

"involves not simply a sequence of ideas but a con-sequence- a consecutive ordering in such a way that each determines the next as its proper outcome while each outcome in turn leans back on or refers to its predecessors" (Dewey 1933, p.4).

How do definitions of thinking translate to essential elements of thinking? The common element of these definitions is that thinking can be defined with action terms. As Beyer (1984) points out, "among educators who agree on the need to teach thinking" the consensus seems to end at that point.

To determine what thinking actions are essential to a comprehensive framework of thinking, this review derived a list of thinking skills from "experts" who presented: (1) formal thinking education programs, (2) models of thinking skills, (3) lists of thinking skills, and (4) types or forms of thinking. A list providing further identification of each of the sources of thinking skills is in Appendix 1.





Table 1 shows a summary of the skills identifiable in different sources, coordinating the skills with the authors who specify the skills. For ease of demonstration in this table, this researcher reduced the label of each skill to an action term.

The results of this overview suggest that it must be a confusing task for an educator to decide which skills are essential to teach in order to improve thinking. It is apparent that there is not an overarching framework of commonly accepted thinking skills as evidenced by:

1. The lack of common terminology. Authors have used different terms to label similar skills, as well as different terms to refer to sets of similar skills, e.g., reasoning, cognitive skills, cognitive processes, and problem solving skills. Often components overlap and a carefully defined separation of components would eliminate some of the terminology.
  2. Universe of discourse errors. Authors have mixed terms predominantly from the fields of psychology and philosophy to label skills, without concern for how they mix the terms. They assume connections, but have different meanings for terms.
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3. Reductive errors. Some authors use terms limited to one universe of discourse. They reduce thinking to a set of psychological or philosophical characteristics.
  4. Unclear relationships between terms. Relationships of terms are obscure and interpreted differently by different authors. Authors have not always specified rules for the relationships of the components. Some components may be related hierarchically on one list and in parallel on another list.
  5. Lack of inclusiveness. Each list is missing components that appear on other lists. On some lists the components are not sufficiently comprehensive to cover all aspects of thinking.
  6. Model errors. Users of models typically demonstrate four positions of model usage (Decker and Saunders, 1976; Schlessman-Frost, 1984).
    1. They do not understand that there is a question about models.
    2. They do not analyze the model, although they recognize a need.
    3. They accept their model as true and forget that it is just a myth or convenient explanation.
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4. They hold the position that the model determines the meaning.

Thinking tasks emphasized by teachers have been influenced by "models" of learning tasks (Gagne, 1965), ability tests (Guilford, 1956), and types of educational objectives (Bloom, 1956). These models have directed many of the sources of the essential thinking skills, but often the authors have not examined the model used, or noted a connection to a model.

This part of the review of the literature has verified that there is a need for an integrating framework for thinking skills. Additionally, the survey has yielded a list of purportedly essential thinking elements. These elements will be included in the contents of thought style analysis. These authors have not considered the concept of style. The next section examines how the literature has historically presented "style" in thinking.

### Style as Individual Differences in Thinking

Some authors refer to styles of thinking as types of "cognitive" style, defined as individual differences in "perceiving, remembering, thinking and judging" (Kogan, 1976, p.1), and as "general behavioral dispositions that characterize performance in mental tasks" (Baron, 1986, p.175). These individual differences are in the form of cognition rather than the content of cognition or skill level of the performance (Messick, 1970, p.188).

Studies have used measures of style for information about academic and occupational choices, to evaluate education, to understand the effects of development and culture on intellectual performance, to predict the success of educational techniques, and to influence the development of innovative educational technologies (Witkin, 1977; Baron, 1986; DeAvila & Duncan, 1985).

Messick (1970) summarized the nine types of cognitive styles most widely referred to throughout the literature:

1. Field independence/dependence (also labeled as analytic vs. global cognitive style, field articulation, psychological differentiation): Refers to perception of items as separate parts of a whole. Tests identify how a person analyzes parts of a task. Subjects either

generally perceive items separately from backgrounds (analytical), or are more concerned with external referents (global) and more influenced by embedding contexts (Kogan, 1976; Messick, 1970; Witkin, 1977).

2. Scanning: Refers to intensity of attention, span of awareness. Tests measure length of attention span.
3. Breadth of categorizing: Refers to how broadly or narrowly the thinker sets limits for categories. Tests identify how many categories are identified, what types of categories, and the rules for establishing the outer limits of the categories.
4. Cognitive complexity/simplicity: Refers to interpreting the world in a multidimensional way. Tests identify the number, type, and organization the dimensions.
5. Reflective/impulsive (also labeled cognitive tempo): Refers to the speed of selecting hypothesis and processing information. Kagan and Kogan (1970) refer to this as "degree to which person reflects on validity of response in tasks with uncertain responses." Tests measure the speed with which subjects reach a

hypothesis, and how long they take to answer a question or process information.

6. **Leveling/sharpening:** Refers to how the thinker merges or contrasts similar events in memory. Levelers assimilate things in memory by merging items with perceived similarities. Sharpeners are less prone to confuse similar items and may even judge things to be less similar than they are. Tests identify the range of responses to different tasks, the tendency to treat tasks the same or recognize differences, and the ability to articulate the differences.
7. **Constricted/flexible control:** Refers to susceptibility to distraction. Tests identify if the thinker is distracted by nonessential elements of the task.
8. **Tolerance for incongruous or unrealistic experiences:** Refers to willingness to accept perceptions different from experience. Tests measure person's use of information that is different from their perception of reality.
9. **Conceptualizing styles:** Refers to the rationales given for grouping or categorizing objects. Tests assess an

individual's preference for a particular mode of sorting, which can be identified further by one of three style types (Gray, 1969; Sigel, 1976; Kogan, 1976):

Relational-contextual (or functional-thematic): the preference for categorization based on some thematic or functional relationship among stimuli.

Descriptive-analytic: the preference for categorization based on analysis and differentiation of a stimulus complex.

Inferential-categorical: the preference for categorization by stimuli not readily observable, that is, the use of class label and inferences.

(Wallach & Kogan, 1965; Bain & Yu, 1982; Gray, 1969; Kogan, 1976)

Witkin (1977) has suggested that cognitive styles are characteristically:

1. Process variables that represent ways of reaching goals rather than success at achieving goals.

2. Pervasive, or function across a variety of different cognitive functions and behavior, implying a consistency in behavior. Witkin referred to styles as: "specific skills welded into characteristic, self-consistent modes of functioning found pervasively throughout an individual's cognitions, that is perceptual and intellectual activities" (1977, p.66).  
Messick (1970) summarizes the prevailing idea of cognitive styles as "habits that are spontaneously applied without conscious choice in a wide variety of situations."
3. Stable over time. Most studies identify types of styles with the idea that once identified, a person's style can be predicted in other tasks.
4. Bipolar. An individual's style is usually identified as one type or the opposite type, rather than along a continuum of functioning. (Wallach & Kogan, 1965).

Concepts of cognitive style are inadequate in the following ways:

1. The characteristics of style are questionable. Many studies assume that styles are pervasive with the implication that styles are not voluntarily chosen. Other authors suggest that style dimensions are under the thinker's control and can be learned, so that a choice of

styles is available to the thinker (Baron, 1985; Messick, 1970).

Authors also criticize the characteristic of bipolarity, with the implication that one end of the range is superior to the other end of the range. Baron (1985) suggests that another property of styles is that the optimum style is usually not at either end, but rather at some point along a continuum between the two extremes. Further, in most tests subjects do not know the optimum performance, and they should be told (Baron, 1986).

Authors disagree about how generalizable cognitive styles are. Some studies suggest that identification of style is not generalizable beyond specific tasks (Kagan and Kogan, 1970). However, other studies suggest that stylistic preferences generalize across different tasks (Kogan, 1976; Baron 1987). Critics have also questioned the stability or predictability of styles because of the variability of the subject's behavior, and testing conditions. Kagan and Kogan (1970) cite this assumption, that the subject acts the same in all contexts, as one of the errors of cognitive variation studies.

2. The means of identifying styles. Style tests may not be measuring what they claim to measure. Tests that identify style are highly influenced by other variables that may not

be taken into account. Kagan and Kogan (1970) suggest that most style testing procedures present subjects with intellectual tasks that the subject wishes to complete successfully. This format results in test anxiety and affects other variables that may have greater influence on measurements of style than researchers have considered. Baron (1985) suggests that style measures may be affected by a person's values, expectations, and habits (e.g., people can have lax criteria for evaluation because they value answering quickly), which in turn may be affected by emotions and beliefs. There have not been adequate explanations of the effects of problem format, problem content, practice, environment, or attitude of the test taker.

3. Inability to distinguish style from levels of skill development (Laboratory of Comparative Human Cognition, 1982). Definitions of cognitive styles are not well distinguished from thinking skills and processes. Many measurements of style require specific cognitive skills.

In addition to these criticisms, these concepts of cognitive style differ from the approach proposed by this paper in the following ways:

1. Lack of flexibility in obtaining information about style. Tools used to measure style are not generally usable by thinkers to identify their own style. People

are limited to using most forms of assessment during specific testing conditions rather than in any context. Researchers have not defined behaviors of different styles well enough that observers could analyze in different contexts.

2. Purpose for measurement. Researchers have identified style based on performance on one test, measuring one stylistic dimension. Few researchers have used style tests to identify patterns of thinking used, or performance in a variety of contexts.
3. Type of measurement. Cognitive style tests identify the result of the task, not what subjects did to get there. The pattern of thinking cannot be identified from the result.
4. Lack of a model relating style to thinking. Researchers have not identified a model of thinking or style analysis. They have not placed components of thinking in any relationship. Style has not been identified in terms of the different categories and variables of thinking. Baron (1985) criticizes previous style studies as arbitrarily choosing styles, and suggests a framework for the study of styles through which thinking tasks can be analyzed by phases or functions.

5. Consideration of deliberate choice of styles. Style can be considered to be a voluntary parameter of a person's thinking. However, most studies of style have not addressed the problem of how one can deliberately select a thought style in any given context.
6. Context. There has been little concern with identifying the contexts in which certain styles may be more powerful than other styles, how to identify and select which style to use, or how to develop a full range of styles from which to choose.
7. Variety of styles. Studies involving a set of cognitive styles usually restrict the recognition of many styles and do not account for the multiplicity of differences among thought styles.

There are many criticisms of cognitive style, and a wide discrepancy between those concepts and the approach taken by this paper. However, there is information to glean for the proposed idea of style analysis. From this review we derive these components of individual differences to include in this study's analysis: attention, speed, categorization abilities, conceptualization abilities. The next section will address another approach to the "style" question.

### Style as Patterns of Thinking

A different approach to improve thinking from that presented in the overview of authors listing skills to teach, as well as an alternative approach to thinking style from that presented by studies of cognitive style, has been explored and explained in the works of Saunders (1969), Davis & Saunders (1973), and Decker and Saunders (1973). This theory of style was introduced in Chapter II; more background will be provided here to explain the history of thought style and to show why educators need a form of analysis.

Davis adopts Kallen's (1942) assertion that "the analysis and description of style should be done with words that designate action. What is doing rather than what is static or done." Davis has defined five kinds of thought style in terms of the type of goal orientation and the syntax style, or how the categories are combined and prioritized. These style types are:

1. Transient- No long range goals. Thinker moves from one idea to another with no deliberate order and no completion.
2. Digital- Single short range goal. Thinker uses a stereotyped procedure with no variation in sequence.

3. Multiple goal- Recognized intermediate goals as means to long range goal. Thinker uses options in topic or procedures toward achieving a goal.
4. Adjunctive- Recognized alternative long range and intermediate goals. Thinker changes the structure to meet new goals.
5. Retroductive-Goals can be reconstructed. Thinker can select a style deliberately.

Davis's view of thought style allows identification of thought style based on patterns of thinking. However, it does not provide a means of easily identifying the components of a pattern to profile a style type, which limits one's ability to select thought patterns deliberately. How is one to identify "the content of the stylization procedure" used by the thinker? This approach looks at the big picture, but what are the pieces? What locations, levels and depths of the Cube can be used? What are the elements of the pattern? How does one determine how to put the pattern together?

Saunders (1971) explained a format for identifying thought style in "Think Tanks: The Stylization of the Inarticulate." This approach was further elucidated by Saunders and Decker (1973) in Doublethink, a book of exercises designed to teach thinking by improving

intelligencing processes. These authors summarized some of the important skills of intelligencing as vocabulary, similarities, spatial relations, and comparative analysis. The book provides exercises in picture analysis, fast word naming, word inclusion, word definitions, and sorting that show readers how to diagnose their own thought styles. The authors defined thinking style as the number of options the thinker could confront when solving problems. They described each of the intelligencing skills in terms of three levels of meaning, allowing readers to determine the level at which they reacted habitually during judgment processes. They designed activities to "help structure and restructure judgment skills . . . to make reactions into deliberate patterns . . . which were to become category habits" (Decker & Saunders, 1973, p.158).

The book emphasized three types of thinking styles:

1. Lineal thinking- Thinker stays on one track without alternatives.
  2. Adjunctive thinking- Thinker can place things in context by exploring alternatives, but may have too many options to make decisions.
  3. Retroductive thinking- Thinker leaves the field to place the field in perspective, incorporating levels one and two.
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Thinking style was scored as the sequence of the levels used across the five different exercises, resulting in style patterns such as 1-1-1-1-1 or 2-2-2-1-1. Once readers could learn to describe their own thinking style, they could learn to make it deliberate. Decker and Saunders also examined these styles in terms of which would be most appropriate for success in different situations, particularly occupational areas. This suggested that style was useful, and that the importance of recognizing thinking styles is the ability to be deliberate and to select a style that fits the situation.

The three levels of thinking were further explained in the context of the Inquiry Cube, which is "the model designed to describe the sequence and interrelationship of the levels of abstraction in the judgment process" (Decker & Saunders, 1973, p.170). The Cube was the instrument used to diagnose the judgment process, or thinking style.

What is missing that is necessary for a thought style analysis?

1. Explanation of a procedure for identifying style.

Authors have described different locations of the Cube, but they have not provided a procedure for determining the sequence of judgment through the Cube. The sequence of thinking analyzed in Doublethink is a sequence of levels through five specific tasks. It is

not a sequence of levels and depths of the Cube usable in any thinking task.

Thinking style analysis, for the purposes of this paper, includes more than the number of options confronted for each task; it must be able to explain the pattern used throughout the complete Cube. The description of thought style produced thus far does not describe how to identify what relationships the thinker uses among the different levels and depths of the Cube. What are the connectives used between parts of the pattern? How can thinkers describe style so that it can be replicated?

2. More explicit explanations of how common thinking terminology fits in the Cube. Since this book was written, there has been more emphasis on teaching thinking "skills." How does this notion of thinking skills fit into the Cube? How can the thinker describe thinking in terms of the Cube?
  3. Discovery of additional style options. These authors classified thought styles with a limited number of types rather than providing a means of analyzing a potentially unlimited number of styles. The combinations of the various describable components of style should logically result in more than three or
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five types. Do additional styles exist? How is one to identify additional styles?

The thought style work of Davis and Saunders provides the basis for developing a form for thought style analysis. In proposing future implications for their study, they suggested that alternate styles might be identifiable by tests. In addition, computer pattern profiles could be plotted to "identify by the combinations of sequences, intensities, and duration of different levels the patterns as followed in designed situations" (Davis & Saunders, 1973, p.78). More important than identification of a type of thought style is that thinkers understand that patterns can be deliberately selected, learned, and constructed. The most inclusive pattern of thought provides for the "construction of the directing controls for individual action and growth" (Davis & Saunders, 1973, p.82).

In order to be aware of thought patterns, to identify alternate thought patterns, and to select or plan patterns, a form that describes the patterns is necessary. The next chapter will discuss the form for analyzing thought style.

### Summary

This study examined different approaches to thinking

to determine:

What experts in different fields consider essential elements of thinking. Review of research confirmed the absence of an integrating framework for thinking skills. There is no consensus about what is necessary to improve thinking.

What typical evaluations of thinking style include. The limitations of these approaches were criticized as lacking in many areas. The considerations of style presented in this study diverge substantially from those used historically.

What previous studies of identification of thought style using the Cube model contribute to this study. Although these studies constructed the theory undergirding this study, they did not provide a facile means of organizing and examining components of thought style. They also did not describe components explicitly enough to codify in a computer program.

The results of this examination suggest the need to describe thinking more carefully. This study uses a model for thought style to design a procedure and tool for analyzing thought patterns. To include experts'

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information about thinking, the study compiled elements of thinking that were sorted into an integrating framework to illustrate that the model of thought style can explain most terminology related to thinking. This study uses a thought style identification model detailed in previous studies. However, it also provides a system for recording information from manifestations of thought style, a means for examining this information according to the categories and variables of thought style, and explanations to enable different uses for the process.

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## CHAPTER IV

### THOUGHT STYLE ANALYSIS

"The undefined pervasive quality of an experience is that which binds together all the defined elements, the objects of which we are focally aware, making them a whole. The best evidence that such is the case is our constant sense of things as belonging or not belonging, of relevancy, a sense which is immediate"  
(Dewey, 1934, p.193).

This study has developed a process to examine characteristics of thinking patterns to analyze a person's thought style. This chapter provides a tool for effectuating the process. This tool provides a means for analysts to track components of thought style. It is also intended as the basis for developing a computer based expert system. To do this, the process using the tool had to include asking questions to gather information about style, and making conclusions about type of style based on the answers. This study has focused on the questions that need to be asked, and a means of asking the questions, and gathering the answers, in such a way that information about patterns can be examined and compared.

This chapter will explain how to:

Identify data, which is the describable characteristics of the content, form, and use of thought patterns.

Analyze patterns by interpreting data within the framework of thought style, and evaluating information in terms of comparison to other thought styles.

Use the results of the pattern analysis to describe or identify, choose, and prescribe thought styles.

### Identification of Data

The system a thinker uses to structure thinking consists of describable components and a form, or structure, for relating the components. Pattern analysts can ask questions that require information about how the thinker structures thinking. To get this information, analysts must make observations about thinking that are recordable as data. Data must be collected so the analyst can identify: (1) the locations of the Cube used in the thinker's pattern, (2) the relationships between the locations, (3) the alternatives explored, (4) the sequence through the Cube, (5) the timing of the pattern, (6) the context in which the thinker uses the pattern, (7) the purposes and results of using the pattern, and (8) the

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orchestration of the different forms of thought style that permits the thinker to select a form as well as a content.

The remainder of this section describes the components of a thought pattern in such a way as to let the analyst recognize and identify data. This section will explain how to identify:

1. Thinking acts according to locations in the Inquiry Cube.
2. Relationships between thinking acts in a pattern.
3. Purposes for using the pattern.
4. Context for using the pattern.

### Thinking Acts

Thinking acts, as described by the locations of the Cube, are "what" the thinker orders in thinking patterns. There are many ways to describe thinking activities; for purposes of this study, analysts must know how terminology referring to thinking activities can be identified in terms of Cube locations. In Table 1 (see page 48) terminology was arrayed that was gathered from different authors who have conceptualized components of thinking processes. Table 2 shows the results of sorting the terms according to locations in the Cube.

Generic terms were used to label each location and to direct the types of actions that occur in that location (Saunders, 1972). An analyst can describe any thinking act using an action term and locate a corresponding location in the Cube.

The analyst must identify the location of the Cube, the duration of an activity at that location, and the intensity of the use of that location. To identify the duration, or length of time, at a location, the analyst must recognize the changes between locations. Activities at each location are timed as a single event in the thought pattern. The length of time for each event is the duration at the location. To identify the intensity, or number of alternatives explored, at each location, the analyst must recognize variations in actions at the same location. The alternatives that a thinker explores at a location in the Cube include different actions at that location, or the same type of action with different contents.

Table 2.

# **THINKING SKILLS SORTED BY SAUNDERS' INQUIRY CUBE**

<b>INTEGRATE</b> synthesize / connect conceptualize build / develop / compose formulate relate / identify relationships plan / strategize set goals predict identify consequences generalize 1-3	<b>EVALUATE</b> judge diagnose decide discriminate determine 2-3	<b>ESTABLISH</b> legislate conclude infer induce deduce solve reason 3-3
<b>COMPARE</b> analyze recognize alternatives recognize similarities recognize differences contrast compare sort group categorize classify 1-2	<b>INVESTIGATE</b> experiment test search / choose solution hypothesize apply / follow rules abstract sequence / series / order pattern / structure identify fallacies 2-2	<b>REVIEW</b> reflect revise reorganize review repeat 3-2
<b>EXPLORE</b> acquire data attend know observe perceive recall recognize remember sense 1-1	<b>IDENTIFY</b> define describe clarify comprehend understand translate extrapolate label question explain 2-1	<b>NOTE</b> assume identify assumptions believe 3-1

## Relationships

The analyst must describe the relationships, or transitions, between activities at different locations of the Cube. Relationships are found in the language used by the thinker in making the transition, or the language used by the analyst in describing the transition. Connectives are words that signal the relationships. The analyst can identify relationships by the presence of different types of connectives. Types of connectives can be sorted by their purposes, such as:

1. Conjoining connectives join parallel ideas.  
(e.g., and, as, then, also, since, as well as)
2. Qualifying connectives qualify ideas.  
(e.g. furthermore, but, if, then, generally, indeed, in other words, for example, for instance, so, as well as, also, moreover, that is, in general, until, too, just as, still, especially, similarly, although, theoretically, perhaps, yet, such, in fact, while, when, apparently, in addition, at least)
3. Direction changing connectives signal alternatives or make comparisons.  
(e.g., so that, on the other hand, furthermore, in other words, however, moreover, even though, in addition to, meanwhile, rather, in contrast, as opposed to, in turn, thus)

4. Inferential or causal connectives consider goals, link answers, or signal a solution to problems.

(e.g., consequently, because, if...then, either...or, so that, rather than, as a result, except, whereas, in contrast, despite, meanwhile, even though, hence, unless, in spite of, nor, in turn, thus, therefore, so, moreover, as a result of)

(From Saunders, T.F., "Learning to Learn," Title III Project, Tucson Public Schools)

To gather data about relationships, the analyst uses these connectives to identify the types of relationships between thinking activities in the sequence of the locations in the Cube.

#### Purposes for Using a Pattern

Thinkers can select the components of a thinking pattern and how to put the components together based on the purpose for the thinking. The thinker may state a purpose at the beginning of the thought process. The analyst may also be able to identify the purpose from the type of task assigned to a thinker. The analyst can view the result of the task to evaluate whether the thinker achieved the purpose; however, an evaluation of results is not within the scope of this study.

One characteristic of a thinking pattern is quality. The identification of resulting qualities, at this stage in the development of the analysis procedure, is mostly subjective. Analysts could use different terms to differentiate qualities (e.g., creative, curious, impetuous, dull) associated with specific patterns. However, the purpose of this paper does not include evaluating qualities or labeling patterns with quality terms.

#### Contexts for Using a Pattern

To diagnose a persistent style used by a thinker, the analyst must consider what thought patterns are used in different contexts. The description of the context in which although style was analyzed is an essential part of the analyst's data. To identify contexts for a thinking task, such things as the type of task, the location of the task (e.g., work, school), whether the task was individual or group oriented, or whether someone assigned the task or the thinker was self-directed, are all relevant descriptors.

Analysts need an instrument to transform the multiple aspects of the collected data to coherent, integrative information by quantifying the observations. The following section describes a form to collect the data and to place the components in a framework for analyzing thought style.

### Structure of Thought Style Analysis

This section provides a form for thought style analysis and explains the procedures to:

1. Collect and code the data about the thinking pattern.
2. Analyze the pattern according to the structure of thought style.
3. Diagnose the thought style by comparing styles.

Each step of the process provides a set of questions for the analyst or a computer based expert system to ask.

#### **Collect Data**

The thinking pattern for a thinking task consists of a series of thinking acts or events with connections between the events. The data which will lead to pattern identification consist of observations of these events and their concomitant connections.

This section provides a paper-and-pencil format for recording data, and a procedure to completing the form. Analysts can gather data by observing thinkers, or thinkers can self-report and record the data. The first section of this chapter presented an explanation of the types of data to record. The observation recording form, shown in Table 3, is used to record data from any thinking pattern, of any length, in any context. The completed form in Figure

7 provides an example of how to record the observations the analyst makes about the thought pattern.

The initial step in using the Thought Pattern Observation Recording Form is to select an activity to analyze which requires thinking. One must plan to gather data throughout the activity. Using as many pages of the form as necessary to describe the complete pattern, the observer records data following a sequence (these steps are noted on the completed form, Figure 7):

1. Complete the identifying information. Identify the thinker, the activity, the purpose for the activity, and the context in which the data recording is taking place.
2. Record the thinking acts, or events, as they occur. Describe each events on the rows, in the Events column, by labeling the thinking act (e.g., analysis). Use a different line for each distinguishable thinking act. If the event is in a previously used Cube location, indicate whether additional alternatives are being explored. If the

**Table 3. THOUGHT PATTERN OBSERVATION RECORDING FORM**

**Name:** \_\_\_\_\_ **Context:** \_\_\_\_\_  
**Activity:** \_\_\_\_\_ **Purpose:** \_\_\_\_\_

[illegible]

# THOUGHT PATTERN OBSERVATION RECORDING FORM

① Name: J. Doe Context: School English Class  
 Activity: Write Report - Time in Minutes Purpose: Compare Biographies of Authors

Components of Pattern Events ②	③ Inquiry Cube Locations							Connective Types ⑤				② Comment		
	1-1 Explore	1-2 Compare	1-3 Integrate	2-1 Identify	2-2 Investigate	2-3 Evaluate	3-1 Note	3-2 Review	3-3 Establish	Conjoining	Qualifying		Changing	Causal
Identify purpose													X	because
Determine value of approach													X	so
Acquire information - background	10											X		in contrast, furthermore
Research - examine alternatives		5									X			in general
Examine history									5				X	therefore - and are in
Acquire more info - library	10									X				and
Acquire info - data base	5										X			but what does this are
Sort & organize info		20											X	therefore
Synthesize info			10										X	so
Plan the report			20								X			apparently
State assumptions & limitations							2			X				and
Define new terms				5						X				then
State hypothesis about results					5								X	in order to do this
Determine rules for report					10								X	therefore
Examine alternative info				5									X	which means
Re-synthesize info				5								X		however
Apply rules to structure info					5								X	therefore
Judge value of info						5				X				and
Determine info to use							2						X	resulting in
Re-structure remaining info							10			X				apparently
Identify relationships of info				5									X	then
Organize report - follow rules					30								X	then
Evaluate report						10					X			however
Revise report							10			X				also
Compare report to plan		2											X	therefore
Determine if report meets purpose							2						X	therefore
Conclude report								10						

Figure 7. Completed Thought Pattern Observation Recording Form

event is a pause, or cannot be described as a thinking act, label the event and include the duration in the label (e.g., "5-minute pause"). Use the space for comments at the end of the row to provide more information when necessary.

3. Identify the Cube location corresponding to the activity, by locating the box in the Events row at the appropriate location.
  4. Mark the duration of the activity in the column box that corresponds to the Cube location. The duration could be represented by a measure of time, written in minutes or hours, represented by a symbol (similar to musical notes), or by a scale or code representing lengths of duration (e.g., 1= brief, 10= extended, etc.). If duration is very brief, it may be appropriate to put only a mark at the appropriate location, rather than an indication of time.
  5. Record the relationship between each event. Identify the connective used by the thinker, or designate the transition with a chosen connective, if appropriate. As an event changes, mark the box under the corresponding connective type at the end of that event. If no relationship can be described, leave the box blank.
  6. Connect the Cube locations to create a visual representation of the pattern,
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## Analyze Pattern

The data constituting a pattern of thinking in Table 3 describe the components of a specific thinking pattern. At this point, with no additional manipulation, the analyst can answer a set of questions about the observed pattern of thought:

What locations, levels, and depths of the Cube did the thinker use?

What relationships did the thinker employ?

What relationships occur within each location, level, depth?

What locations, levels and depths are connected?

What is the direction of progression through the locations?

At times it might also be useful to have information about specific components of the pattern. One could analyze for specific Cube locations and relationships:

Did the thinker use a specific location, level or depth, of the Cube? (e.g., Did the thinker set goals? Did the thinker use assumptions?)

Did the thinker use a specific type of relationship? (e.g., Did the thinker use any qualitative connectives?)

Were specific locations combined with a type of relationship? (e.g., Did the thinker use a causal connection between the rules for a procedure and the strategy for solving a problem?)

The data from the recording form must be analyzed further to elicit information about how the thinker used the model's components to structure thought. Table 4 shows the Pattern Analysis Form which can be used to effect such a pattern analysis; Figure 8 shows a completed Pattern Analysis Form. The Pattern Analysis Form provides summarized information about the pattern. The analyst, or expert system, must ask questions about the sequence, intensity and duration of components of the pattern.

#### Sequence

Sequence, which is the order of progression through the Cube, emerges through answers to the following questions:

1. What is the sequence of the components of the pattern?  
Describe the order of the components in the pattern by listing the locations and relationships in order:

location 1

relationship

location 2

relationship

location 3

and so on.

(e.g., 1-1, conjoining, 2-1, causal, 1-3)

Table 4. **PATTERN ANALYSIS FORM**

Pattern Sequence: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<div style="text-align: center;"> <b>Components of Pattern</b>  <b>Categories of Style</b> </div>		Inquiry Cube Locations									Connective Types			
		1-1 Explore	1-2 Compare	1-3 Integrate	2-1 Identify	2-2 Investigate	2-3 Evaluate	3-1 Note	3-2 Review	3-3 Establish	Conjoining	Qualifying	Changing	Causal
Sequence	First in Pattern													
	Last in Pattern													
Intensity	Frequency													
	Most Frequent													
	Least Frequent													
	Alternatives Explored													
Duration	Duration													
	Longest Time													
	Least Time													

Total Connections: \_\_\_\_\_  
 Total Locations: \_\_\_\_\_

Total Time: \_\_\_\_\_

# **PATTERN ANALYSIS FORM**

Pattern Sequence: \* See 12/10/42

Components of Pattern  Categories of Style		Inquiry Cube Locations									Connective Types			
		1-1 Explore	1-2 Compare	1-3 Integrate	2-1 Identify	2-2 Investigate	2-3 Evaluate	3-1 Note	3-2 Review	3-3 Establish	Conjoining	Qualifying	Changing	Causal
Sequence	First in Pattern			X										X
	Last in Pattern								X					X
Intensity	Frequency	3	4	5	1	5	4	1	2	1	6	3	3	14
	Most Frequent			X		X								X
	Least Frequent				X			X		X	X	X		
	Alternatives Explored													
Duration	Duration	25	32	71	5	48	20	2	15	10				
	Longest Time			X										
	Least Time							X						
Total Connections: 26														
Total Locations: 26														
Total Time 228 min.														

1-3, causal, 2-3, causal, 1-1, dir. chang., 1-2, qual., 3-2, causal, 1-1, conj., 1-1, qual., 1-2, causal, 1-3, causal, 1-3, qual, 3-1, conj, 2-1, conj, 2-2, causal, 2-2, causal, 1-2, causal, 1-3, chan, 2-2, causal 2-3, conj, 2-3, causal 2-2, conj, 1-3, causal, 2-2, conj, 2-3, chang, 3-2, conj, 1-2, causal, 2-3, causal, 3-3

Figure 8. Completed Pattern Analysis Form

2. Which locations and relationships were used at the beginning of the pattern? Mark the corresponding locations on the chart.
3. Which locations and relationships were used at the end of the pattern? Mark the corresponding locations on the chart.

### Intensity

Intensity is a measure of how many alternatives are explored at a given location. For data keeping purposes, this construct is translated to the number of times, or the frequency, at a location.

1. How many times did the thinker use each location or relationship? Count the number of times a mark was made in each Cube location column on the Observation Recording Form and write the total as the frequency of that location. Obviously, locations with zero occurrences identify the locations, levels and depths that the thinker never used in a particular thinking task.
  2. Which locations and relationships were used most often? Mark the Cube locations with the highest totals.
  3. Which locations and relationships were used least often? Mark the Cube locations with the lowest totals.
  4. Finally, how many alternatives did the thinker explore in a given location? Examine the description of events for each location.
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## Duration

Duration at the different Cube locations is a measure of the pattern's tempo. The times for the individual events provide the answers to questions about duration.

1. How much time was spent at each location? Total the durations.
2. What was the duration of the entire pattern? Combine the totals of all the locations.
3. Which locations or relationships had the longest time or highest proportion of time? Mark the location with the longest amount of time.
4. Which locations and relationships had the least time? Mark the total with the least amount of time.

Different combinations can occur within each of these categories of sequence, intensity, and duration. Combinations result from repetitions, variations, and contrast within the category. Repetitions in a category occur when an element is the same as the preceding or following element; variations occur when the element changes from the preceding element; and contrast indicates an opposite occurrence from the preceding element (Davis and Saunders, 1972).

The categories of sequence, intensity and duration can also be examined in relationship to each other in terms of

combination and priority. Combination refers to how categories are combined in the pattern; priority is the emphasis placed on the selection of categories.

Table 5 provides a Category Analysis Form; Figure 9 shows how to organize the information from the following questions on that form.

1. What was the combination of sequences? Did the thinker repeat some sequences? Did the thinker vary sequences? Did the thinker use contrasting sequences (first going one direction and then the opposite)? Describe these in the spaces labeled Sequence Repetition, Sequence Variation and Sequence Contrast.

Table 5. Category Analysis Form

CATEGORY ANALYSIS FORM

## COMBINATION WITHIN CATEGORIES:

Sequence Repetition:

Sequence Variation:

Sequence Contrast:

Intensity Repetition:

Intensity Variation:

Intensity Contrast:

Duration Repetition:

Duration Variation:

Duration Contrast:

## COMBINATION OF CATEGORIES:

## PRIORITY OF CATEGORIES:

CATEGORY ANALYSIS

## COMBINATION WITHIN CATEGORIES:

- ① Sequence Repetition: *Repeated 12 13*  
 Sequence Variation:  
 Sequence Contrast: *Went back & forth*
- ② Intensity Repetition: *Level - not many alternatives explored at each loc.*  
 Intensity Variation: *None*  
 Intensity Contrast: *None*
- ③ Duration Repetition: *Most of tasks done in 5 minutes*  
 Duration Variation: *Varied 1-40 minutes.*  
 Duration Contrast:

- ④ COMBINATION OF CATEGORIES:  
*Sequence and duration - limited intensity*

- ⑤ PRIORITY OF CATEGORIES:  
*Short duration may have been influencing factor*

Figure 9. Completed Category Analysis Form

2. What was the combination of intensities? Did the thinker repeat intensities? (e.g., Did the thinker examine an equal number of alternatives at several locations?) Did the thinker vary intensities? (e.g. Were the frequency counts across locations variable or the same?) Did the thinker use contrasting intensities? (e.g., Did the thinker explore some locations frequently and other locations not at all?)

Describe these in the spaces labeled Intensity Repetition, Intensity Variation and Intensity Contrast.

3. What was the combination of durations? Did the thinker repeat some durations? (e.g., Were similar times recorded for several locations in order?) Did the thinker vary durations? (e.g., Were a variety of durations recorded?)

Did the thinker use contrasting durations? (e.g., Did the thinker use long durations in some locations, and very short durations in connecting locations?) Describe these in the spaces labeled Duration Repetition, Duration Variation and Duration Contrast.

4. How are the categories combined? How do the categories influence each other? Describe this as the Combination of Categories.

5. What was the priority in use of categories? Determine if one or more of the categories predominated, or if there was no priority in use of categories. The lack of a category indicates low priority, but affects the style. For

example, a style with no duration at any location would be very different from a style that emphasizes long durations at each location over the intensity or sequence of the locations. Indicate the priority as the Priority of Categories.

The results of analysis to this point provide a profile of a thought pattern. The Thought Pattern Observation Recording Form, Pattern Analysis Form, and Category Analysis Form, provide information about how a thinker structures a thought pattern for one type of activity in one context. This procedure is adequate for identifying the pattern used during a particular task. To classify a person as having a particular type of thought style, the analyst must examine a thinker's pattern of patterns; that is how the thinker uses patterns in different contexts for different purposes. Different styles are appropriate for different purposes. Table 6 shows a Pattern Use Form for organizing information about pattern use; use of this form is illustrated in Figure 10.



To use the Pattern Use Form:

1. Analyze several thinking patterns. Observe (1) different thinking tasks in the same context, (2) the same thinking task in different contexts, and (3) different tasks in different contexts. Does the thinker use different patterns? The analyst must determine what variations in which categories are significant to identify patterns that are significantly different. If the thinker uses more than one pattern, organize the information relating the patterns that the thinker uses by different contexts and purposes. Identify each pattern by describing the sequence (location-relation-location), or by assigning labels (e.g., digital, experimental) or numbers (e.g., pattern 1, pattern 2) to different patterns. Describe contexts with different labels as illustrated in Figure 10.

2. Use the results to answer these questions:

How many different patterns are explored?

Under what conditions does the person use which patterns? For what purposes?

Is there more consistency in patterns used in some contexts than in others?

3. Many of the questions that describe a pattern of patterns are the same as the questions used to investigate

specific patterns. Examine the data on the patterns and contexts to answer the following questions:

How many times did the thinker use each pattern?

Which patterns did the thinker use most often?

Which patterns did the thinker use least often?

Which patterns had the longest time?

Which patterns had the least time?

Were any patterns combined? Which ones?

Were any patterns only slight variations of other patterns? Which ones? Which patterns did they resemble?

The pattern of patterns profiles a thinker's pattern habits (which may be purposeful or unconscious). If a pattern is used often enough to typify a thinker's thinking, it identifies the thinker's thought style. Examination of the use of patterns provides answers to these questions about how a person uses style:

Is the person aware of thought style?

Pattern profiles that show little or no connection among patterns used in similar contexts, or that the same type of a pattern is used regardless of the purpose or context of the task may indicate that a thinker is not aware of style.

Does the person change thought style or consistently use the same pattern in the same contexts?

Pattern profiles that show that a thinker uses a limited repertoire of patterns, restricted to similar contexts and purposes, may indicate that the thinker is aware of style, but considers it fixed and unchanging.

Does the thinker value deliberate selection of thought styles depending on context and purpose of task?

Pattern profiles that show many different patterns, varied according to the purposes and contexts of the task, as well as new patterns developed for unfamiliar purposes and contexts, may indicate that a person is aware of style and can choose styles.

### **Diagnose Thought Style**

What is the meaning of the types of information up to this point? What is the value of the results of the analysis? Completing the preceding forms results in the description of thought patterns, and how an individual uses thought patterns. Analysis of habitual thought patterns reveals a thinker's personal style. To identify a person's style as a particular type of style requires diagnosis. Diagnosis of style would result in the labeling of a

specific style type, by analyzing manifestations of the style presented. To diagnose a style as being a particular type of style would require that many thought styles had been analyzed, classified and labeled as different types of style. This has not been done in this study. If different styles were identified, it would be possible to diagnose a person's thought style by comparing the results of the analysis of the persons's thinking patterns with manifestations of other styles to determine which style the person used.

To diagnose a thought style, the analyst would compare the profile of a thinker's thought style with profiles of other thought styles. Table 7, Thought Style Diagnosis, provides a form for organizing this comparison of thought style components. As well as identifying a particular style, this form can also be used to determine how closely a style resembles a target thought style.

To determine if a thought style resembles, or matches another style, the analyst must:

1. Analyze the pattern of thinking that a thinker uses.  
Record the data and answer the questions specified

specific style type, by analyzing manifestations of the style presented. To diagnose a style as being a particular type of style would require that many thought styles had been analyzed, classified and labeled as different types of style. This has not been done in this study. If different styles were identified, it would be possible to diagnose a person's thought style by comparing the results of the analysis of the persons's thinking patterns with manifestations of other styles to determine which style the person used.

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1. Analyze the pattern of thinking that a thinker uses. Record the data and answer the questions specified

Table 7. Thought Style Diagnosis Form

**THOUGHT STYLE DIAGNOSIS**

Thought Style Components		Criteria					
		Sufficient	Necessary	Complete	Selected	Correct	Consistent
Components of Patterns	Locations						
	Relations						
Categories of Style	Sequence of locations						
	Sequence of relationships						
	Sequence of patterns						
	Intensity of locations						
	Intensity of relationships						
	Intensity of patterns						
	Duration of locations						
	Duration of relationships						
	Duration of patterns						
Combinations within Categories	Variation of sequences						
	Variation of intensity						
	Variation of durations						
	Repetition of sequences						
	Repetition of intensity						
	Repetition of durations						
	Contrast of sequences						
	Contrast of intensity						
	Contrast of durations						
Arrangement of Categories	Combination of categories						
	Priority of categories						

in the previous sections. If the evaluation is to include the thinkers' use of thought style, ask the questions about the pattern of patterns.

2. Determine the profile to compare to the thinker's profile. This may be the profile of a target style, or it may be the profile of a previously identified, and labeled style. Both profiles to be compared must have answers to the questions about locations and relationships, the sequence, intensity and duration of the components of the pattern, the variation, repetition, and contrast within the sequences, intensity, and durations, and the priority and combinations of the categories.

3. Use the Thought Style Diagnosis form provided in Table 7 to compare the thinker's style to the target profile.

This form provides an organized means of asking necessary questions about each component:

Were the components necessary? (Were all parts of this component needed or were some extraneous and not in the target style?)

Were the components sufficient? (Were enough parts included that the profiles are similar in this aspect?)

Were the components complete? (Were all parts included meaning the profiles match on this aspect?)

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Were the components correct? (Of the types of parts that were included, were the components all accurate, or were there errors?).

Were the components consistent? (Did these components agree in the comparison patterns?)

For example some of the specific questions are: Was the sequence of the locations sufficient? Was the duration of the pattern complete?

Answer these questions by comparing the information about the derived thought style to the target thought style. Specify ranges of acceptable answers for each question if the components do not have to match exactly. Specify weightings for certain questions if some components of style are more important than others. Then decide whether both the patterns were the same, or within an acceptable range of similarity.

4. Determine how closely the thinker's thought style resembles the target style by examining the number of "yes" responses in the comparison. The analyst can also use the results to determine which areas could be changed to cause a greater resemblance to the target style.

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The analyst can use the Thought Style Diagnosis form to compare any two thought styles or to evaluate how well the analyzed thought style met the purposes of a task. The questions would then be in terms of the task rather than another profile (e.g., Was the priority of the categories correct for this task? ).

### Use of Thought Style Analysis

The preceding sections of this chapter have explained how to conduct a thought style analysis. This section will explain the use of this analysis.

A central presumption of this paper is that thinkers can improve thinking by thinking about thinking, and being deliberate about choosing thinking patterns. How can the results of thought pattern analysis and thought style identification to describe replicable patterns of thinking enable the deliberate selection of different styles for different purposes, or the valuing of specific styles in specific contexts?

This section will explain how to use the set of forms generated for thought style analysis to:

1. Describe a thought style by gathering information to answer the question "What thought style was used?"

2. Select or plan a thought style by "mapping out" the pattern for a thinking task in answer to the question "What thought style could be used?"
3. Prescribe a thought style based on criteria specific to the thinking context. A prescription for thought style would answer the question "What thought style should be used?"

### **Description**

Using the forms as explained in the previous sections will "track" a thinker's actions, describing the thought style. The analyst gathers data from analyst observations that describe a behavior, or thinker self-reports or answers to questions about an activity. Thinking activities may be during oral, written, or motor activities. Thinking activities can be examined as they are happening, or audio or videotaped for later examination. Thinking activities can be naturally occurring events, tests, or simulations.

Describing thought style can enable the recognition of options in thought styles, and inform goals for learning thought styles. Thinkers need the opportunity to learn different thought patterns before they can deliberately choose styles. Evaluation of thought styles is necessary before well-informed choices can be made.

## Selection

"Deliberate stylization requires categories and methodizing such that meanings can be re-instituted as qualitative combinations. A model for such a concept of style is necessary" (Saunders, 1969).

To select thought style deliberately requires thinking about thinking to plan, and pace, the pattern of thinking. How can a thinker develop a strategy of using the Cube to enable selection of thought styles for different purposes? The perception of alternate thought styles and the act of selecting from among alternatives requires a type of thought style allowing recognition of alternatives.

To choose a thought style, thinkers must be able to value one thought style over another for different purposes. To be deliberate the thinker must be able to select and use a structure for thinking. Thought styles may be selected from among alternative, predefined styles, or they may be created for a purpose. To match an existing style, thinkers must describe analytically the target style as completely as possible, and attempt to match style components. Matching and comparing styles could be used to fit learners' styles with teachers' styles, or job styles with workers' thinking styles. To create a style, a thinker can purposefully chart the pattern in advance or plot it during progress.

## Prescription

Prescription requires valuing certain styles over other styles, and identifying target thought styles best suited for different tasks. This requires that thought styles can be evaluated in terms of criteria that judge the components of style and the effectiveness of the resulting quality in different contexts.

Prescription of thought style recommends a particular style as more desirable than other styles in a specific context. To determine an optimal thought style for any task, one must initially compare thought styles by evaluating the results or consequences of doing the task using different patterns. Thought styles that resulted in the best evaluation may be the optimal thought styles for the task. Examination of the optimal thought style would yield a target pattern. To prescribe thought style based on task results would require a more thorough examination of the qualities of different thought patterns than is appropriate for the scope of this paper. The desired qualities become the criteria for directing the thought style. However, this study has focused on pattern analysis, not aesthetic evaluation.

Prescription of thought style can also help a thinker learn new thought styles. One would use the analysis to

identify a thinker's thought style, compare the pattern with any target pattern, identify the differences, and suggest how to change a pattern to approximate a valued pattern more closely.

### Summary

This chapter presented a tool for tracking a thinker's pattern of thinking, and a procedure for analyzing the patterns. The procedure emphasized asking questions about components of thinking defined in terms of thought style. This approach was followed to lay the foundation for a computer based expert system to do the tracking and the analysis. Thinkers can use this procedure to examine alternative thought styles, to reinstitute any thought style, and to improve thinking by selecting and prescribing optimal thought styles to match the context and purposes of any thinking task.

## CHAPTER V

### EPILOGUE

The one certainty about the future is that it will require changes. Rapid technological advances are continually changing the way we work, play, live, even the way we think. Machines accomplish complex thinking tasks once the exclusive domain of humans, however, machines do not think, they follow rules legislated by people. Once restricted to hardware and software limitations for directing thinking tasks, improved technology will provide us with "wetware" for more immediate communication between human brains and machines. Who will design the "wetware?" What will the design for thinking be in the future to allow for the greatest expansion of humans' options? How do we assure that any design for thinking includes the valued qualities of thinking? How will we know that we have preserved these qualities for our qualitative future?

This study has been an attempt to systematize the identification of thinking patterns that result in different

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qualities of thinking. For thought style analysis to be at all useful for directing qualities of thinking, improvement and use of the system must be planned. Considerations for the immediate future of thought style analysis suggest the need to:

Develop and test prototype forms. Reorganize the form as necessary to minimize errors and maximize information.

Determine the degree of reliability with which analysts can use the forms and procedure for analysis as proposed by this study.

Study large numbers of people for validation purposes. Results could be used to classify style types, or to correlate styles with age, job, culture, intelligence, or personality.

Develop a systematic means of identifying qualities resulting from different thought patterns. Different patterns with specific qualities could be assigned terms that identified the style. By modeling different style types and having raters judge the quality by

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selecting different labels, future research could develop a rating scale that identified style types with labels. These labels could be sorted and organized using the Inquiry Cube.

Design a method for aesthetic evaluation. How do we evaluate the quality of a pattern? In order to select patterns based on valued qualities, there must be a way to establish values for competing qualities.

Distinguish "styles" of style. If the essential components of any thinking style can be specified, then the range of variation among these components can be explored. Within a given style of thinking, different thinking patterns may produce the same quality. For example, it would be possible to produce the quality of "humorous" with different thinking patterns. Each distinguishable pattern might be a different "style" of humor.

While the present form of thought style analysis requires that people gather and interpret the data, the future form will use computers in the process in several ways. For example, this current process could be adapted so that the computer could aid the analyst by:

- (1) recording and timing the thinking events,
- (2) transcribing the data onto appropriate forms,
- (3) illustrating the results with graphic representations.

As planned, this process can also be adapted for a computer based expert system. Expert systems make decisions based on rules. The current form of thought style analysis could provide foundation for the development of a knowledge base of rules for gathering and interpreting information about thinking patterns. Rules about the recognition of patterns would aid in the identification, selection and prescription of thought styles. An expert system could help users select thought styles by selecting and combining thinking elements in patterns, based on their purposes or desired results.

An expert system could also prescribe thought styles. By analyzing the thought styles of "experts" in different fields during the course of thinking tasks in their specialty, "optimum" thought styles could be suggested for different tasks. Templates of thought style goals could be developed, as well as continually reinforced and updated by ongoing analysis of people who perform well at their work or school situations. This would provide a range of target patterns for particular jobs or studies. Analysis could inform thinkers about how closely their thought style

resembles a target thought style, and identify the stylistic dimensions that differ.

Information could be provided to a computer aided system of analysis as:

- 1) Answers to questions about hypothetical situations.
- 2) Results of a simulation or game.
- 3) A report of actual events that happened during the course of any thinking activities such as solving problems.
- 4) The user's deliberate selection of activities corresponding to locations in the Cube to conduct an inquiry into any subject.

By the time the user answered questions about thinking tasks, or completed thinking tasks at the computer, the expert system would be able to identify a thinking pattern. By analyzing the thinker's pattern use in multiple contexts, a program could identify typical patterns, or thought style.

Computers could also help thinkers learn thought styles. Simulations and games could be designed to encourage specific thinking patterns. The user could experiment with patterns, or practice patterns prescribed for different contexts. At a lower level of computer use, drill and practice and tutorial programs could be used to work on specific content skills. These could include the

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components used in the thinking pattern, the ordering or structuring of the components or the speed through the task.

### Future Implications of Thought Style Analysis

Potential applications of thought style analysis include:

1. Learning situations. Learners could select thought style for thinking and learning tasks and teachers could match educational tasks with students thought styles.
2. Work situations. Business managers could match employees' thought styles with job requirements. Workers could select appropriate thought styles to complete jobs, or select careers according to preferred or successful thought styles.
3. High technology situations. Machines could complete thinking tasks using appropriate thought styles, as well as aid people learning thought styles as mentioned in the previous two situations.

This system provides a chance for the ultimate democracy in learning. Goals for thinking can be clearly described, and the patterns needed for thinking can be prescribed. Learners and thinkers can select appropriate

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thought styles for different contexts. Futures can be deliberately chosen and constructed.

Without a system for improving the quality of thinking, for helping thinkers deliberately plan how to think, there will continue to be problems with less effective thinking and learning, poor or arbitrary job and classroom placement, less effective work with job dissatisfaction, and less hope for an improved quality of life in the future.

#### Summary Topics

Thought style analysis in the future holds the possibility of expanding thinkers' options by providing the foundation for recognizing and choosing optimal thought styles. Technology assisted thought style analysis could make the analytic process readily available to any person. Results of this process may be used to improving the quality of thinking, which could eventually lead to improving the quality of life.

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## APPENDIX A

### THINKING SKILLS SOURCES

The thinking skills compiled in chapter III were gathered from these sources.

<u>TITLES/AUTHORS</u>	<u>COMPONENTS</u>
Phases of Reflective Thought (Baron, 1986 )	
Phases of Thinking (Belth 1977)	
Thinking Operations (Beyer, 1988)	Thinking Strategies Critical Thinking Skills Information Processing Skills
Taxonomy of Educational Objectives (Bloom, 1956)	
Phases of Reflective Thought (Burton, 1960)	
Hierarchy of Thinking (Costa, 1985)	Discrete Skills of Thinking Strategies of Thinking Creative Thinking Cognitive Spirit
Forms of Thinking (Costa, Hanson, Silver, Strong, 1985)	
Cognitive Skills Matrix (Cradler, 1985)	Enabling Skills Processes Operations
Phases of Reflective Thought (Dewey, 1933)	

**TITLES/AUTHORS****COMPONENTS**

A Taxonomy of Critical Thinking  
Dispositions and Abilities  
(Ennis, 1987)

Dispositions  
Abilities

Conditions of Learning  
(Gagne, 1977)

Common Types of Thinking  
(Glatthorn & Baron 1985)

Critical Thinking Skills  
(Kneedler, 1985)

Define Problem  
Judging Information  
Solving Problems/  
Drawing Conclusions

Philosophy for Children  
(Lipman, 1987)

Dispositions  
Mental Activities  
Cognitive Skills

Tactics for Thinking  
(Marzanno, 1986)

Learning-to-Learn Skills  
Content Thinking Skills  
Reasoning Skills

Hierarchy of Cognitive Tasks,  
Skills and Processes  
(Phye, 1986)

Cognitive Tasks  
Cognitive Skills  
Cognitive Processes

Higher Order Thinking  
Strategies and Processes  
(Quellmalz, 1987)

Strategies  
Processes  
Cognitive  
Metacognitive

Phases of Thinking  
(Samson, 1965)

Universe of Critical Thinking  
Skills  
(Winocur, 1985)

Enabling Skills  
Processes  
Operations

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