NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, tests publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30.

Canada

THE UNIVERSITY OF ALBERTA

SPELT (STRATEGY PROGRAM FOR EFFECTIVE LEARNING/THINKING): AN ANALYSIS OF THE INSTRUCTIONAL MODEL, INSERVICE TRAINING, AND INSERVICE EFFECTIVENESS

BY

DAVID WILLIAM PEAT

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

IN
SPECIAL EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL 1988

ISBN 0-315-45467-9

SPELT International, Ltd.
207 Manor Court
Sherwood Park
Alberta, Canada.
T8A 0S8
Phone: 1-403-464-4877

October, 12, 1988

The University of Alberta Library

Dear Sir/Madam:

We are pleased to grant you permission to reproduce single copies of the following pages of David William Peat's Master of Education Thesis, containing copyright materials. Permission is granted for the selling or lending of the materials providing they are used for private, scholarly, or research purposes only, and that a notice of copyright is included with each copy.

Page numbers and details of David Peat's Master of Education Thesis (Fall, 1988) to which this permission applies:

1. SPELT Instructional Model: Pages 49 & 103.

2. Inservice Evaluation Form: Pages 127-129.

We appeciate your cooperation and support for the principles of copyright compliance.

Yours truly,

David Peat

David Peat, Publications Director, SPELT International, Ltd.

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: David William Peat

TITLE OF THESIS: SPELT (Strategy Program for Effective Learning/Thinking): An Analysis of the Instructional Model, Inservice Training, and Inservice Effectiveness

DEGREE: Master of Education

YEAR THIS DEGREE GRANTED: Fall, 1988

(Signed) David Peat

PERMANENT ADDRESS:

609H Michener Park

Edmonton, Alberta

T6H 5A1

DATED Oct 13 19 88

"The world that we have made as a result of the level of thinking we have done thus far, creates problems we can not solve at the same level at which we created them."

ALBERT EINSTEIN

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled SPELT (Strategy Program for Effective Learning/Thinking): An Analysis of the Instructional Model, Inservice Training, and Inservice Effectiveness submitted by DAVID WILLIAM PEAT in partial fulfillment of the requirements for the degree of Master of Education in Educational Psychology.

.....
Supervisor

.....

.....

Date ..Oct. 4/88.....

ABSTRACT

The various thesis chapters are intended to present an in-depth evaluation of the SPELT (Strategies Program for Effective Learning/Thinking) program on a number of differing fronts for the purpose of enhancing its further development. Chapter I entitled, 'Review, Clarification & Consolidation of SPELT Instruction' offers a review of the Cognitive Education literature in terms of theory, research and salient issues. It emphasizes the development and present crystallization of theory and data, both qualitative and quantitative, from one author's perspective, that applies to SPELT instruction.

Chapter II, centering on methodology, presents a detailed analysis of the SPELT Instructional Model in terms of recent conceptualizations of instructional design principles.. This analysis has as its goal the consideration of whether or not the SPELT Instructional Model uses effective and efficient instructional procedures to achieve the desired student outcomes as detailed in the program.

The question of what training is needed by teachers in order to be adequately prepared to be an effective teacher of learning/thinking has not received adequate emphasis or attention (Nickerson, in press). Chapters III and IV begin to address this concern by evaluating the inservice component of SPELT instruction. Chapter III deals with the process of teacher inservice training in cognitive education. Major principles and instructional techniques are identified which facilitate the process of teacher training before, during and after inservice instruction. Chapter IV describes SPELT inservice training, including its evaluative component. Information regarding procedures used in monitoring program implementation as well as the results of a follow-up teachers' questionnaire are presented, followed by a brief summary and conclusion.

Chapter V attempts to integrate the information presented in previous sections into general recommendations for further development, improvement, application and training of SPELT instruction. These suggestions, through a collaborative process with the other three authors, may influence the future editions of SPELT.

ACKNOWLEDGEMENTS

To my wife, Robyn who has been a constant source of encouragement, support , understanding, love and friendship; to my children, Daniel, Bethany, and Stephen, who have displayed tolerance and love; and to Dr. R. Mulcahy, for his support, friendship, and invaluable insights and feedback.

I also wish to thank my committee members: Dr. Conn-Blowers, and Dr. Fagan for their insightful feedback.

To my friends Jonas Darko-Yeboah & Bob McClelland, I express my appreciation for their encouragement, editing, and technical expertise.

"For from him and through him and to him are all things. To him be glory forever!" (Rms. 11: 36).

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER IV

LIST OF FIGURES

INTRODUCTION

The Cognitive Education Project, University of Alberta

The context for writing substantial portions of this thesis was provided by the Cognitive Education Project (CEP). Established in the fall of 1984, the CEP is a cooperative venture involving: 1) the Government of Alberta, Department of Education; 2) the University of Alberta's Department of Educational Psychology, and 3) various school jurisdictions in north-central Alberta. It was established with the general purpose of undertaking a long-term evaluation of two cognitive education programs in relation to conventional instruction. This three-year longitudinal study of two experimental programs in relation to conventional classroom instruction, is currently in progress and will be completed in December, 1988.

The specific objectives of the project are threefold:

> (a) **to assess the relative effectiveness of the two programs in terms of their impact on students' affect and motivation, academic achievement, cognitive ability, and learning, thinking, and problem-solving strategies,**
> (b) **to examine the differential effects of the programs, if any, on gifted, normal achieving, and learning disabled students, and,**
> (c) **to ascertain the feasibility of implementing learning and thinking strategies instructional programs on a large scale as part of the regular curriculum of schools, as well as to identify appropriate methods for providing the level and quality of teacher training necessary for such implementation** (Mulcahy, Andrews, & Peat., in press).

A brief description of each program follows.

Instrumental Enrichment, consisting of 15 "instruments", is an **out-of-content** program utilizing paper-pencil tasks and intensive teacher-pupil discussion, or as described by IE, mediation. The exercises focus on the development of learning and thinking strategies such as systematic search, planning, hypothesis testing, etc. These strategies, as they are being developed, are also systematically transferred to academic, social, one-on-one, and vocational settings. Instrumental Enrichment is one of the most comprehensive and field tested learning/thinking programs available to date (Mulcahy et al, 1988). It is appropriate for upper elementary, middle and secondary students (Presseisen,1988).

SPELT, developed at the University of Alberta, emphasizes the teaching of learning/thinking strategies directly **within content** across the curriculum. The SPELT approach consists of three basic components: a) general teaching method and orientation, b) the teaching of a set of recommended or teacher-generated strategies, and c) teaching toward students' control and self-generation of learning/thinking strategies (Mulcahy & Marfo, 1987; Mulcahy, et al, 1986).

The common goal of the above two programs is to ultimately help students learn 'how to learn' and thus to become independent, organized, active, and purposeful thinkers and problem solvers. Both require that teachers obtain intensive inservice, of about five days duration, before implementation. The major difference between the two programs is the out-of content approach of IE versus the in-content orientation of SPELT (Mulcahy et al, 1988).

Nickerson (in press) notes that "solid evaluation data on approaches to the teaching of thinking are sparse" (p.37), particularly studies emphasizing long term effectiveness. The CEP is one attempt to begin to rectify this situation.

Thesis Scope

Due to FIE's (Feuerstein, Rand, Hoffman, & Miller,1980) being a static, published and marketed product, and in the interests of brevity and practicality, this thesis will consider only the SPELT program.

The SPELT Manual, Research Edition (Mulcahy, Marfo, & Peat. 1984), was initially designed for use in grades 4 - 9 regular classrooms. The authors recognized that as teachers began to use the publication, their feedback would be helpful in its further development. Also, as research and theorizing in the fields of cognitive education and curriculum design progressed during the course of the five year longitudinal study, this new information would be integrated into future editions, as would the results of the CEP itself. Some of this knowledge has indeed been used in a new inservice edition of SPELT (Mulcahy, Marfo, Peat, & Andrews, 1987), but refinement is necessary as new input is received. The 'nature of the beast', i.e. the teacher's manual format, limits the depth and volume of material that can practically be presented to teachers for either reading

and/or inservice training. The thesis presented here is not limited to field application and can thus serve as a forum for the integration of some of the ideas and data acquired from both the literature and the field to date during the course of the CEP.

The data from each year of the longitudinal study are analyzed, with results being reported in an on-going fashion (Mulcahy, Peat, & Andrews, in Press; Mulcahy, et al, 1986, 1987, 1988). Thus, the information contained in those documents will not be duplicated here. Rather, the emphasis will be on *program development* and *teacher inservice training*.

Overview of Thesis Chapters

The various thesis chapters are intended to present an in-depth examination of the SPELT program on a number of differing fronts for the purpose of enhancing its further development. Chapter I entitled, 'Review, Clarification & Consolidation of SPELT Instruction' offers a review of the Cognitive Education literature in terms of theory, research and salient issues. It emphasizes the development and present crystallization of theory and data that applies to SPELT instruction, both qualitative and quantitative, from one author's perspective. Suggestions as to how to improve SPELT's content, organization and presentation are given, and through a collaborative process with the other three authors, these may influence the future editions of SPELT.

Chapter II, centering on methodology, presents a detailed analysis of the SPELT Instructional Model in terms of recent conceptualizations of instructional design principles. This analysis has as its goal the consideration of whether or not the SPELT Instructional Model uses effective and efficient instructional procedures to achieve the desired student outcomes as detailed in the program.

The question of what training is needed by teachers in order to be adequately prepared to be an effective teacher of learning/thinking has not received adequate emphasis or attention (Nickerson, in press). Chapters III and IV begin to address this concern by exploring the **inservice** component of SPELT instruction. Chapter III deals with the process of teacher inservice training in cognitive education. Major principles and instructional techniques are identified which facilitate the process of

of teacher training before, during and after inservice instruction . Chapter IV describes SPELT inservice training, in light of teacher evaluation data obtained from those who have taken part in SPELT workshops. Information regarding the procedures used in monitoring program implementation, as well as the results of a follow-up teachers' questionnaire, are also presented.

Chapter V attempts to integrate the information presented in previous sections into general recommendations for further development, improvement, application and training of SPELT instruction.

Thesis Audience

The thesis is written following a "paper format", with each chapter standing as an independent publication. This arrangement allows each paper to be written for specific audiences, with differing styles and levels of vocabulary used, varied according to the needs of the target readers. The intent is to facilitate a more rapid dissemination of the information contained in each chapter, as compared to the "traditional" thesis format.

Chapter I, written for educational practitioners, was designed as a backdrop for the rest of the thesis. An overview of the broad area of cognitive education is proffered in terms of current theory and practice. Chapter II, emphasizing a theoretical analysis of SPELT's instructional procedures, is aimed at academics and/or researchers, and to a lesser degree, administrators and teachers. Educational administrators/teachers are the main target audiences of the third chapter. The information contained therein is meant to be of practical import in the decision making process re inservice training in Cognitive Education. Chapter IV, presenting evaluative data obtained from teachers involved in SPELT inservice training, is addressed to a wide audience -- administrators, researchers, and teachers. It is hoped that this thesis, with the individual papers being disseminated to a wider audience, to some small degree, will raise the awareness of the educational community to the importance of making the teaching of learning/thinking a major educational goal.

REFERENCES

Feuerstein, R., Rand, Y., Hoffman, M. B., & Miller, R. (1980) Instrumental enrichment. Baltimore: University Park Press.

Mulcahy, R. F., Andrews, J. & Peat, D.W. (In Press). Cognitive education: A longitudinal examination. Proceedings of National Conference on Cognition and Literacy, Saskatoon, October, 1987.

Mulcahy, R., Cho, S., Peat, D., Marfo, K., Clifford, L., & Henderson, H. (March,1986). A longitudinal examination of Cognitive Education: A Progress Report. 60 pages. University of Alberta, Cognitive Education Project.

Mulcahy, R., Clifford, L., Peat, D., Marfo, K., Norman, C.,& Cho, S. (June, 1987). A longitudinal evaluation of Cognitive Education: Second Progress Report 150 pages.University of Alberta, Cognitive Education Project.

Mulcahy, R., Darko-Yeboah, J., Andrews, J., Peat, D. , Marfo, K., Clifford, L., Cho, S. & , Norman, C. (February, 1988). A longitudinal evaluation of Cognitive Education: Executive Summary: Year 3. 63 pages.University of Alberta, Cognitive Education Project.

Mulcahy, R. H., Marfo, K. (1987). Assessment of cognitive ability and instructional programming with native Canadian children: A cognitive processes perspective. In L. L. Stewin & J. H. McCann (Eds.), Contemporary Educational Issues The Canadian Mosaic (pp. 157-177). Toronto, Ont: Copp Clark Pitman.

Mulcahy, R. H., Marfo, K., Peat, D. W. (1984). SPELT: A Strategies program for effective learning and thinking-Research edition. (Available from the Cognitive Education Project, Department of Educational Psychology, University of Alberta.)

Mulcahy, R. H., Marfo, K., Peat, D. W., & Andrews, J. (1987). SPELT: A Strategies program for effective learning/thinking-Inservice edition. (Available from the Cognitive Education Project, Department of Educational Psychology, University of Alberta).

Mulcahy, R. H., Marfo, K., Peat, D. W., Andrews, J., & Clifford, L. (1986). Applying cognitive psychology in the classroom: A learning/thinking strategies instructional program. Alberta Psychology, 15, (3), 9-12.

Nickerson, R. S. (In press). On improving thinking through instruction. Prepared for Review of Research in Education.

Presseisen, B. Z., (March,1988). Introducing thinking into the curriculum. Phi Delta Kappa Educational Foundation workshop materials. Philadelphia, PA: Research for Better Schools, Inc.

CHAPTER I-REVIEW, CLARIFICATION & CONSOLIDATION OF SPELT INSTRUCTION

The SPELT program (Mulcahy, Marfo & Peat, 1984; Mulcahy, Marfo, Peat, & Andrews, 1987) was designed as a means of conceptualizing and presenting a large number of cognitive strategies to teachers who, in turn, would impart this "how-to-learn" knowledge to their pupils. SPELT represents just one of many cognitive education programs to be recently developed with the goal of enhancing learning and thinking capabilities through direct instruction (Mulcahy et al, 1986; Lefrancois, 1988).

Cognitive instruction "refers to any effort on the part of the teacher or the instructional materials to help students process information in meaningful ways and become independent learners (Jones, 1986, p.7)." Cognitive Education programs are mainly based on the general information processing conceptualization of learning as a process in which the planful, organized, and independent activity of the learner is of central importance (Mulcahy, Andrews & Peat, in press). Jone's (1986) definition is broad enough to include programs emphasizing the modification of underlying cognitive processes (Feuerstein, 1980), intelligence education (Sternberg, 1986; Whimbey & Lochhead, 1980), formal reasoning (Lipman, Sharp & Oscanyan, 1980) 'learning-how-to-learn' (Dansereau, 1985; Deschler, Warner, Schumaker, & Lenz, 1983; Weinstein, 1982), creative and critical thinking (deBono, 1980), decision making, problem-solving (Bransford & Stein, 1984), and specific and metacognitive strategy teaching (Meichenbaum, 1986; Mulcahy, Marfo, Peat & Andrews, 1987) (Black, 1986; Woolsey, Pace, Reid & Mulcahy, 1988).

To place this educational direction in an historical context, the challenge of teaching <u>good</u> thinking is not a new (Glaser, 1984; Marzano et al, 1988; Nickerson, in press). However, over the centuries, the teaching of higher-order thinking has been a goal, not of mass education, but of elite education (Resnick, 1987). "A case can be made that the continuing and as yet unresolved tension between the goals and methods of elite and mass education produces our concern regarding the

teaching of higher order skills (p.3)". (For a comprehensive historical overview see, Cuban, 1984; Glaser, 1984; Nickerson, in press; Resnick, 1987; Schuell, 1986).

This paper addresses several questions relating to cognitive education. Why teach thinking? How strong are the research and theoretical foundations of this new educational direction? What are some implications of this orientation for such crucial issues such as teacher training, assessment and mainstreaming? Based upon this review, how can the SPELT program be improved in terms of its content, organization and presentation?

Why Teach Thinking?

Numerous authors have presented rationale statements as to why helping students to become more effective and efficient thinkers is a laudable goal. The reasons given can be roughly divided into at least four categories: a) the characteristics of present and future societies, b) an analysis of students thinking capabilities and performance, c) empirical data supporting cognitive interventions, and d) an analysis of present teaching practices.

Characteristics of Present and Future Societies

Demands of the "Information Age"

The developed world has entered the "post-industrial information age". Very different demands are imposed on the workforce currently than those required of them during the industrial society of the past century-and-a-half. The information explosion of this time era, is characterized by an unprecedented rate of emerging knowledge, involving a large proportion of workers' processing and communicating information. The time period during which half of the information pertaining to some disciplines becomes outdated is as little as six years. Students can thus no longer afford to solely learn the content knowledge of a subject area, but now must also acquire the life-long *how-to-learn* and *thinking* skills necessary to acquire and process information within ever-expanding fields of knowledge (Maher & Schwebel, 1986; McTighe & Schollenberger, 1985;

Mulcahy, Andrews, & Peat, in press; Nickerson, in press). A recent task force on learning strategies and thinking skills (Nickerson, et al, 1985), took the position that a more appropriate goal of primary and secondary education today is to produce *learners* --people who have the motivation and ability to learn on their own--rather than to produce *learned* individuals.

On the local scene, the above mentioned requirements of the information age are reflected in Alberta Education's the official policy re educational goals and practices. For example, Principle #3 of the *Secondary Education in Alberta Policy Statement* states "Secondary schools must prepare students for responsible citizenship in a society which is changing constantly. The best preparation for students to enable them to anticipate and shape the future is a broad general education with emphasis on critical and creative thinking, communication, personal development, science and technology, and an understanding of the community (Alberta Education, p. 8)". As well, the set of priorities for the total provincial curriculum as documented in *Essential Concepts, Skills and Attitudes for Grade 12* (Alberta Education, 1987, May) includes critical and creative thinking. They are seen as "essential to solving personal or family crises, or proposing creative alternatives in the job situation (p. 5)".

The content and design of support documents, curriculum guides and teacher resource manuals presently being produced by Alberta Education adhere to these priorities (For examples see Alberta Education, 1987; Alberta Education, 1988). A recent substantive initiative by the Curriculum Branch is the development of a framework for supporting the teaching of thinking skills among subject areas and across grade levels (Alberta Education, 1987, March, June). This document provides an analysis of the kinds of thinking skills documented in the literature to be used as a guide in developing curricula.

Citizenship

Democracy has as one of its foundations the existence of an informed and intellectually able citizenry that can exercise their democratic responsibilities. This citizenship requires an understanding of political, social and economic systems. The ability to think critically about issues

facilitates a democratic contribution to the solution of problems in these areas (Nickerson, 1986; McTighe & Schollenberger, 1985). However, as Norris (1985) powerfully points out, there is often "a breakdown between critical thought and action, a link that instruction in critical thinking is intended to forge" (p.43).

The unparalleled complexity and threatening nature of some current national and world problems are not because of a lack of raw intelligence or technology, but are "direct consequences of our cleverness and technological wizardry. We are now smart enough to destroy ourselves as a species and, unless we learn to be better thinkers in a broad sense, we may well do so" (Nickerson, 1986, p.32).

The organization of societies are in part, an outcropping of human beings' ability to learn and think. Homo sapiens, like no other species, rely more on cognition and less an instinct. Students who become good thinkers are more fully expressing what it means to be human. "Thinking well is a means to many ends, but is also an end in itself" (p.32.).

An Analysis of Students' Thinking Capabilities and Performance

Although students need to develop their thinking skills, there is, unfortunately, overwhelming evidence which indicates that students do not think as effectively as they might (Marzano et al, 1988; Nickerson, in press). We all organize, analyze, categorize, etc. When we say students need to develop their thinking skills what is actually meant is that students need to improve their thinking; they need to perform intellectually to their full potential. Just two examples of the present unsatisfactory performance of students in this area will serve to make the point. Norris (1985), using data from both traditional critical thinking multiple-choice measures and a think-aloud procedure, presents a review of systematic research in the area of critical thinking. He concludes that the student level of critical thinking is not extremely high at any level of schooling, including university students enrolled in MBA and medical programs. The second example, as described by Presseisen (1985) as explicit and demanding action, comes from the American *National Commission on Excellence in Education* (Goldberg & Harvey, 1983). It reports that many

17-year-olds do not possess the higher order intellectual skills expected of them; nearly 40 percent cannot draw inferences from written materials, only one-fifth can write a persuasive essay, and only one-third can solve a mathematics problem requiring several steps.

The above comments which refer to students in general, are magnified when one examines the learning characteristics of those with learning difficulties. They can be viewed as being strategy inefficient or deficient in that they: a) do not monitor their reading comprehension to ensure that they are obtaining meaning from the text (Wong, 1985); b) do not apply task-appropriate strategies (Torgesen, 1980); c) have more difficulty in planning organizational strategies for approaching a task (Wong, 1982); d) fail to engage in strategic behavior in order to restore meaning when there has been a breakdown in understanding; and e) fail to change or modify their strategies to meet varying task demands (Palincsar & Brown, 1987). Given these pervasive characteristics, if it is important to enhance the thinking skills of 'regular' students, then how much more so for those with learning difficulties.

Empirical Data Supporting Cognitive Interventions

To present a more positive picture, research clearly points to the effectiveness of cognitive interventions with differing populations (see Deschler, Warner, Schumaker & Alley, 1983; Hallahan, et al, 1983 [LD]; Scott, 1988 [Gifted]; Dansereau, 1985; Weinstein, 1982 [College students]; Brown & Campione, 1977 ; Mulcahy, R. 1980 [MR]) and within a wide assortment of subject areas (see Jones, Palincsar, Ogle, & Carr, 1987; Nickerson, in press; Schoenfeld, 1985; Wittrock, 1986). Research at the University of Alberta over the past few years has also supported the need for, and the utility of a strategy approach in educational intervention (for example, Andrews, 1984; Lupart & Mulcahy, 1983). "Cognitive instruction has the potential to alter substantially the capability of the learner, especially the low-achieving learner, in much the same way that microchips radically altered the capability of the computer.....Explicit learning strategy training facilitates learning for low-achieving students, and there are strong data to suggest that

cognitive instruction decreases the differences between younger and older students" (Jones, 1986, p.8, 9).

An Analysis of Present Teaching Practices

Several frameworks have been used for investigating teaching practices. The behaviorists' S-R paradigm is reflected in studies relating various characteristics of teaching directly to student achievement. Such research is known as 'process-product' or 'process-outcome' research . This approach has produced an orderly knowledge base linking teacher behavior to student achievement for the teaching profession to draw upon (Brophy, 1986; Brophy & Good, 1986; Brophy & Porter, 1988). However, it fails to adequately account for what takes place in the students' minds which, in turn, influences performance.

An ancient, but newly revived "cognitive" approach has dominated research over the last 25 years (Schuell, 1986), and takes the following view. Teaching influences students' thought processes. Students' thinking, in turn, mediates achievement and learning (Wittrock, 1986; Joyce &Weil, 1986). "What the students do with the information presented by the teacher-what sense they make out of it, how they relate it to what they know and believe-influences achievement" (Wittrock, 1987, p.30). The teaching-students' thinking, and the students' thinking-performance links have direct implications for the teaching of thinking. Information gleaned from two major educational research thrusts will serve to illustrate this point: a) studies emphasizing teachers' questioning behavior, and b) those investigating the relationship between teacher praise and learning.

The type of questions teachers use have been shown to directly influence student achievement (S-R Paradigm). Further, these effects may be differential for divergent sub-groups of students. For example, rephrasing questions and giving longer time to answer, are factors which facilitate maximum performance for students with 'low-ability'. In contrast, the gifted perform better if the questioning proceeds at a quick pace, and when inferior work is periodically criticized (Bachor, 1985). The cognitive perspective helps to interpret the reasons as to why different teacher

behaviors have these differential effects; how students' thought processes affect their performance. These questioning techniques give information to the students as to the teacher's expectations. For the 'low ability' students the teachers' questioning behavior tells them that they are expected to think and that they will be provided with the time to think through a response. In short, thinking is required and important. For the gifted, the students' perceive the teachers' questioning behavior as challenging them to think quickly, but at a high level.

There is a positive relationship between the level of teachers verbal behavior and the level of thinking of students (Costa, 1985c), although Brophy (1986) in his review of the relevant literature terms the findings as mixed. He makes a case for the use of lower level questions as a way to set the stage for higher level questions. Costa, (1985c) correlates various levels of question and statements with desired cognitive behaviors. Teacher's questioning behavior, thus directed, is intended to facilitate students accepting information, processing or comparing that information with what they already know, drawing meaningful relationships, and applying or transferring those relationships to hypothetical or novel situations. An analysis of major programs and instructional strategies designed to enhance thinking, reveals the importance of dialectic discussion strategies (Costa, 1984).

Teachers praise or reward is often reported as increasing learning. Research emphasizing the reinforcement aspect of teacher praise (S-R paradigm) suggests that it should be used frequently, contingently, and discriminatively, However, recent classroom research found that praise is actually used very infrequently as a reinforcer. Using the cognitive approach in examining the students' thought processes, it was found that students gain information from the teachers use of praise re answers, desired behaviors, and teacher's expectations of performance . Thus praise was used more as an informational function rather than as a reward (Brophy, 1981; Wittrock, 1986).

Teaching practice then, influences student thinking which, in turn, affects students' performance. Knowing this, many teachers value the teaching of thinking as an educational goal and use methods that facilitate its development. However, these teachers are not the norm. Most teachers do not employ techniques and approaches which foster the development of thinking in their

students (Joyce & Weil, 1986; McTighe & Schollenberger, 1985). Further, even with the best of instruction, spontaneous transfer of cognitive skills is not nearly as frequent as one would expect (McKeachie, 1987).

To summarize the above answer to the question, "Why teach thinking?": a) it is necessary in order for students to function in the present information age and to be able to tackle the many and complex problems facing them as citizens of the twentieth and twenty-first centuries; b) the present level of students' thinking is not at its optimum level; c) interventions have shown to be effective in improving the thinking abilities of students; and d) present teaching practices, on the whole, do not reflect the use of methods and techniques which facilitate the development of students' thinking skills.

Implications

A task force evaluating the present status of the teaching of learning strategies and thinking (Nickerson, et al, 1985), and whose findings parallel the information above, put forth a number of recommendations with respect to the educational scene in the United States. These included: (1) a need for more research on learning and thinking strategies, particularly with respect to enhancement of student performance through training; (2) a need for more emphasis to be placed on facilitating the transfer of research results to classroom practice; and, (3) the need for the teaching of learning and thinking strategies to be closely coupled with the teaching of conventional content material. These recommendations reinforce the need for a more collaborative effort in both research and teaching from all those concerned with fostering student cognitive development, and especially for those working with students with learning difficulties (Mulcahy, Andrews & Peat, in press).

The preceding sections provided a rationale for the teaching of thinking as a major educational goal. However, in order to develop new teaching methodologies and techniques to achieve this goal and also to critically analyze present programs and methodologies which emphasize the teaching of thinking, current conceptualizations of learning and thinking should be clarified.

What is Learning?

There seems to be a general agreement in nearly all conceptions of learning, whether behavioral or cognitive, that three criteria should be used in its definition :("a) a change in an individual's behavior or ability to do something, b) a stipulation that this change must result from some sort of practice or experience, and c) a stipulation that the change is an enduring one" (Shuell, 1986, p.412.).

How we as educators view learning directly effects how we present, design or teach content to students (Clark & Peterson, 1986; Jones, Palincsar, Ogle & Carr, 1987). Instructional methods and materials mirror assumptions about learning. To illustrate, those who view learning as the accumulation of a vast knowledge base in a specific subject area, would probably emphasize the learning of that content. In contrast, those who view learning as a process of understanding, would likely encourage and facilitate students to use a factual knowledge base, perhaps coupled with the explicit teaching of learning/thinking strategies, as a means of making sense of their world.

At present there are at least six propositions about learning that are educationally significant, have a sound research base, and have critical implications for instruction (Jones, Palincsar, Ogle & Carr, 1987). Note that these "new" propositions about learning all have a base in cognitive psychology, the present mainstream of thinking in both psychology and education (Shuell, 1986). Cognitive psychology is concerned with various mental activities related to human information processing and problem solving. It stresses that learning is an active, constructive and goal-oriented process, dependent upon the mental activities of the learner (Shuell, 1986).

The six propositions about learning are as follows:

1. Learning is Goal Orientated:

Skilled learners strive to reach two goals: to understand the meaning of the task, and to regulate their own learning (Gagne´, 1977, 1985; Gagne´ & Briggs, 1979; Jones, Palincsar, Ogle & Carr, 1987; Wittrock, 1974). In reading, for example, the model reader actively works to figure

out or construct the meaning of what is read and to monitor understanding at any given time (Brown & Campione, 1986; Flavell, 1979; Jones, Palincsar, Ogle & Carr, 1987; Sanacore, 1984). As well as these "global goals" the reader also may have specific goals in mind such as finding the main idea for summarization, or simply skimming to obtain the gist of the material (Jones, Palincsar, Ogle & Carr, 1987; Paris & Oka, 1986).

2. Learning is Linking New Information to Prior Knowledge:

Prior knowledge, stored in memory as schema (the sum of what the individual knows about a topic or thing), is retrieved by model learners in order to facilitate understanding and organization of new information. This approach is applied in problem solving (Bransford & Stein, 1984, Schoenfield, 1985), in writing compositions (Scardamalia and Berieter 1986), and in the reading process. For example, model readers begin the reading process by skimming textual features such as titles, graphics, subtitles, and/or chapter introductions and summaries. This activates schematics relating to the new content and/or the organizational structure of the text. The reader then uses this information to predict and hypothesize about the meaning of the text and the authors intentions. This process of comparing existing schemata in terms of fit with new information; of making inferences about the meaning of unclear portions of the text; of applying the meaning of what is read to understand phenomena external to the text; of establishing the relationship amongst ideas presented; and of changing one's prior knowledge, continues throughout the reading (Anderson, 1980; Doctorow; Wittrock & Marks, 1978; Jones, Palincsar, Ogle & Carr, 1987).

3. Learning is Organizing Knowledge

Organizational patterns, that is, identifiable arrangements of information both 'inside' and 'outside the head', are known to model readers. The compare-and contrast pattern, for example, can exist both in the mind as well as on paper. These structures, which can be general in nature (i.e. found in various disciplines), or subject specific (i.e. "region" frame in geography including

the categories of surface features, rainfall/weather conditions, etc.) have distinctive characteristics. Skilled readers recognize and use these structures to both comprehend and produce information effectively (Jones, Palincsar, Ogle & Carr, 1987; Pearson and Johnson, 1978).

Research indicates that proficient readers impose organization upon disorganized textual material, whereas, less skilled readers do not. This suggests that providing well-organized information is especially important for low-achieving students (Weinstein & Underwood, 1985).

4. Learning is Strategic

This proposition is highly related to the preceding section in that learning strategies are the means of, or the tools used for, generating relationships between what is already known and new information (Marzano et al, 1988). Effective learning involves being able to access learning/thinking strategies with flexibility. Also involved is knowing when to use a given strategy and when to abandon it for another. Expert learners appear to spontaneously develop learning strategies throughout school without specifically designed interventions. However, younger and less efficient learners do not. Their performance can be enhanced by explicit strategy teaching. Unfortunately, many skills and strategies do not transfer unless directly addressed in teaching. These same skills (i.e. activating prior knowledge, representing the text or problem, summarizing, etc.) or strategies may be critical across various content areas for acquiring in-depth comprehension (Derry & Murphy, 1986; Jones, 1986; Jones, Palincsar, Ogle & Carr, 1987; Mulcahy, Marfo , Peat & Andrews, 1987; Weinstein & Underwood, 1985).

5. Learning Occurs in Phases, but is not Linear

The notion that learning occurs, or progresses in phases is not new (Shuell, 1986). The view is based upon info-processing lines of research which show that reading, writing and problem-solving are complex thinking processes which require different skills and strategies at different stages of learning. Although there is not agreement as to the delineation and labels to use when describing these phases, a helpful framework is:

a) preparation for learning,

b) on-line processing, and

c) consolidating/extending.

These stages are not viewed as occurring in a linear fashion, but rather occur in repetitive cycles such as when one is engaged in processes such as re-thinking, re-writing, re-formulating ideas, checking reasonableness of answers, etc (Jones, Palincsar, Ogle & Carr, 1987).

Given strategies or variables may facilitate learning during one phase, but have little, if any effect during other phases. For example, pictorial and verbal mnemonics may provide the structure necessary to learn facts during initial knowledge acquisition in a specific domain, with repetition being a critical factor. However, as learning progresses, organizational strategies may play an increasingly important role. Once the knowledge base is established, mnemonics would not have a major effect on learning since the information is already structured into a meaningful integrated whole (Shuell, 1986). Their function instead would be to facilitate retrieval of information already known.

6. Learning is Influenced by Development:

Learning is a developmental process. This proposition is a cornerstone of Alberta Education's initiatives in curricula design and evaluation (Alberta, 1987). Research comparing experts and skilled learners versus novices strongly supports this view. Some of the differences identified relate to differences in prior knowledge (Chi, Glaser, & Rees,1982; Glaser, 1984), the repertoire of cognitive and metacognitive strategies (Palincsar & Brown, 1987; Torgesen, 1980; Wong, 1982, 1985) and the degree of automaticity (Pressley, Goodchild, Fleet & Zajachowski, 1987). It is not clear whether or not these differences are apparent at the onset of schooling, or whether they develop over time. Probably the two situations combine and, if intervention for the weaker students does not take place, tend to be self-perpetuating (Jones, Palincsar, Ogle & Carr, 1987).

Metacognition

Of central importance in all of the above of statements about learning is the role of metacognition. Metacognition is defined as, " knowledge and cognition about cognitive phenomena" (Flavell, 1979), or, to put it more simply 'thinking about thinking'. It is being aware of our thinking as certain tasks are performed and using this awareness to control what we are doing (Marzano et al , 1988).

Two types of metacognitive activities appear to be involved in learning. The first is an "executive" function which regulates and orchestrates various activities that must be carried out for learning to be successful (i.e. planning, monitoring of the learning process, guessing, predicting, etc.). Since learning is goal orientated, this function is concerned with organizing the resources and processes involved in achieving the goal. The second type of metacognitive activity is concerned with what one does and/or does not know about the material being learned and the processes involved in learning it (i.e. metacognitive knowledge) (Shuell, 1986).

Flavell (1979) suggested that four types or variables are involved in metacognitive knowledge: a) person variables-knowledge about ones own strengths, weaknesses, and skills; b) task variables- knowledge about the way the nature of the task influences performance on the task; c) strategy variables- knowledge about which strategies might enhance and/or detract from performing well on the task; and d) interactions-knowledge of the ways the other three variables interact with one another to influence performance on some cognitive tasks (Mulcahy, Marfo, Peat & Andrews, 1987; Shuell, 1986).

In recent years much research attention has been focused on metacognitive skills and knowledge, attempting to understand better the role they play in our thinking and how they might be taught (Nickerson, in press). These investigations have particularly emphasized the areas of reading and memory. For example, a recent review of the metamemory literature (Schneider, 1985), concluded that there is a substantial relationship between one's knowledge of memory processes and performance on memory tasks.

In reading, a major project was designed and carried out to "test the relation between metacognition and reading comprehension, or more precisely, the relation between children's independent use of reading strategies and their awareness of the existence, application, and benefits of those strategies"(Paris & Oka, 1986). Approximately 500 third-grade and 500 fifth grade pupils received an experimental curriculum (Paris, et al, 1984) that explicitly taught them to use reading strategies as an adjunct to the regular reading material. From this study it was reported that childrens' reading comprehension could be enhanced with the provision of metacognitive knowledge about effective strategies by their regular teachers when presented in addition to the usual reading program.

The preliminary research findings of the Cognitive Education Project at the University of Alberta using one of the same measures (Metacognitive Reading Awareness Questionnaire, Paris & Oka 1986) and age group, but with SPELT as an intervention, parallel those of Paris and his associates (Mulcahy, Andrews, & Peat, in press). These results are particularly interesting since the scope of explicit strategy teaching in SPELT is much broader than in Paris's *Informed Strategies for Learning*. (See Chapter Two of this volume for a more complete description of SPELT).

The emphasis on the teaching of metacognitive skills has emerged as an critical component of cognitive instruction, addressing a perennial educational problem-the teaching for transfer. Teaching for, of and about thinking (Costa, 1985b) has the potential to not only improve the academic performance of pupils in specific areas (i.e. reading & memory), but when the conditions of applicability of learning/thinking strategies are taught along with the strategies (executive skills training), transfer also appears to be successful (Belmont, Butterfield & Ferretti, 1982).

The above section highlights recent cognitive conceptions of learning. The development of effective educational delivery systems *should* reflect what is known about learning and guide the how of teaching. Note that the discussion ended by describing metacognition, a thinking activity. This illustrates the interactive nature of learning /thinking; in fact the two are inseparable, and behave in an interactive fashion (Mulcahy, Marfo, Peat & Andrews, 1987). If we are to develop and evaluate programs which profess to teach learning/thinking (i.e. SPELT), then we must not

only have an understanding of what learning is, but we must also strive to formulate an answer to the question, "What is Thinking?"

What is Thinking?

In the teaching of learning/thinking strategies, the conceptualization of thinking that is adhered to is a major factor determining what strategies are taught to the pupils at the classroom level. However, a review of the related literatures (i.e. critical thinking, creative thinking, reasoning, problem solving, decision making, etc.) and programs emphasizing the teaching of thinking reveals little agreement as to what thinking is. The only point of convergence seems to be that thinking is multi-faceted, complex, and at this point, not yet very well understood (Nickerson, in press).

In order to review the current level of understanding in the area of thinking, three new major publications will be reviewed: a) *Dimensions of Thinking: A framework for Curriculum and Instruction* (Marzano, et al , 1988; b) *Thinking Skills Throughout the Curriculum: A Conceptual Design* (Presseisen, 1987), and c) *Education and Learning to Think* (Resnick, 1987). These three documents were chosen as representative of present attempts to integrate the diversity of the literature on thinking, and to apply this knowledge to the classroom setting.

Dimensions of Thinking

Dimensions of Thinking (Marzano, et al, 1988) presents a framework for thinking "intended to be the basis for curriculum and staff development programs" (p.xi). The aim is to produce a cohesive framework, or "taxonomy" of thinking skills drawn from many diverse research and theoretical sources, including philosophy.

The dimensions, or strands of thinking within the text include:

- Metacognition,
- Critical and Creative Thinking,
- Thinking Processes,

- Core thinking Skills, and
- The relationship between content-area knowledge and thinking.

Notice that in our discussion about learning the topics of metacognition and the relationship between content-area knowledge emerged. This again points to the inseparable nature of and interaction between learning and thinking. The topics of creative and critical thinking, as a detailed discussion re thinking processes did not arise. Consequently for these areas, the perspectives presented in *Dimensions of Thinking* will be briefly addressed below.

Marzano et al (1988) adopt Ennis's (1985) broad definition of critical thinking as "reasonable , reflective thinking that is focused on deciding what to believe or do" (p.54). A reductionist approach is taken by presenting an exhaustive list of disposition and ability goals for a critical thinking program, again adopted from Ennis. The curriculum includes 14 dispositions (i.e. to seek a clear statement of the thesis or question, seek reasons, try to be well informed, use credible sources and mention them, etc), and 12 abilities (i.e. focusing on a question, analyzing arguments, etc.), with each ability further broken down into sub-abilities. Critical and creative thinking are not seen as separate processes, but are **descriptions** of the way processes are carried out.

Thinking is viewed as being made up of processes and skills. Thinking certainly occurs without instruction, but student's ability to perform the various processes can be improved by their awareness and practice of the component skills that make up thinking (Marzano, et al, 1988).

Thinking processes are broadly directed towards either knowledge acquisition or knowledge production/application. Concept formation, comprehension and principle formation are processes viewed as applying primarily to knowledge acquisition; composing, problem solving, decision making and research processes lean towards knowledge production and/or application. The process of oral discourse is used in both knowledge acquisition, and production/application.

These thinking processes are not distinct from one another, but overlap. Concept formation is the foundation of all processes; those processes involved in knowledge production/application necessarily build on the knowledge acquisition components (Marzano et al, 1988). Thinking is not linear, since the various skills are used at many different points in the thinking process. Twenty-

one core thinking skills are presented (see figure 1) "roughly in the order they frequently appear in analysis of the various thinking processes" (p. 66.). The intent is that the information be used for designing classroom instructional units.

Figure 1: Core Thinking Skills as They Frequently Occur in Thinking Processes

FOCUSSING SKILLS
Defining Problems — Setting Goals
INFORMATION GATHERING SKILLS
Observing — Formulating Questions
REMEMBERING SKILLS
Encoding — Recalling
ORGANIZING SKILLS
Comparing — Classifying — Ordering — Representing
ANALYZING SKILLS
Identifying Attributes and Components — Identifying Errors
Identifying Relationships and Patterns — Identifying Main Ideas
GENERATING SKILLS
Inferring — Predicting — Elaborating
INTEGRATING SKILLS
Summarizing — Restructuring
EVALUATING SKILLS
Establishing Criteria — Verifying

(Marzano, et al, p. 66)

Thinking Skills Throughout the Curriculum: A Conceptual Design

Barbara Presseisen's (1987) *Thinking Skills throughout the Curriculum: A Conceptual Design*, presents a concise summary of theoretical and research literature in the area of teaching thinking. The purpose is towards curriculum renewal for improved schooling, and the development of sophisticated, autonomous thinkers in kindergarten through grade 12.

A three level 'working model' of thinking, consistent with current research, is presented as a basic concept for program design. It is intended to be rich enough to account for complex human thought processes. (See Figure 2.)

Figure 2: A Tri-Level Model of Thinking

COGNITION - related to the various thinking skills characteristic of human intelligence, including basic and complex processes;

METACOGNITION - Related to how we become aware of and acquire thinking skills and enable others to use them;

EPISTEMIC COGNITION - related to the collective knowledge produced by thinking and the development and extension of such bodies of information.

(Presseisen, 1987, p.12.)

The basic and complex processes of cognition are clarified by Presseisen (1987) as follows. The complex processes are considered advanced thinking skills since basic processes are essential for the operation of the advanced skills:

A) Basic Processes:

i) Qualification- finding unique characteristics

ii) Classification-determining common qualities

iii) Relationships-detecting regular operations

iv) Transformations-relating known to unknown; creating new meanings

v) Causation-establishing cause and effect, interpretation; predictions; forecasting (Presseisen, 1987, p.14).

B) Complex Processes:

i) Problem Solving-resolving a known difficulty

ii) Decision Making-choosing the best alternative

iii) Critical Thinking-understanding particular meanings

iv) Creative Thinking-creating novel or esthetic ideas/products (Presseisen, 1987, p.26).

Metacognition involves both monitoring task performance and also selecting and understanding appropriate strategies. Improvement in metacognitive skills leads to a greater accuracy of performance in thinking and a more powerful ability to complete the various thinking processes (Presseisen, 1987).

Epistemic cognition has as its basis the cognitive research finding that expertise without an accessible, extensive and organized knowledge base does not exist. This third level of thinking refers to the growing knowledge base acquired through the thinking process, and asks the question, "What processes are embedded in the subject content that challenges the growing intellect of the student and enhance the structure of the subject matter at the same time?"(p. 37).

Education and Learning to Think

Resnick (1987) states that "thinking skills resist the precise forms of definitions we have come to associate with the setting of specified objectives for schooling" (p.2). However, recent research on the nature of human thinking and on the acquisition of learning and thinking skills has led to explicit knowledge re what higher order thinking skills are, and how these skills can be cultivated successfully.

Resnick challenges the traditional reductionist view of thinking as a set of 'lower' and 'higher' order skills, with higher presumably needing to be developed first. "The most important single message of modern research on the nature of thinking is that the kinds of activities traditionally associated with thinking are not limited to advanced levels of development. Instead,

these activities are an intimate part of even elementary levels of reading, mathematics, and other branches of learning-when learning is proceeding well" (p.8). Acquiring particular components of thinking does not ensure that an integrated ability to learn, think and reason and a disposition to engage in higher order thinking will emerge.

Although due to the above, she labels the term 'higher order thinking' as misleading, she does generate a working definition of what she views higher order thinking to be. It is conceptualized as :

-**being nonalgorithmic** (the path not fully specified in advance),
-**being complex** (the total path is not mentally 'visible' from any single vantage point),
-**often yielding multiple solutions** (each with costs and benefits),
-**involving nuanced judgement** (and interpretation),
-**involving the application of multiple criteria** (which sometimes conflict with one another,
-**involving uncertainty** (not everything that bears on a task is known),
-**involving self-regulation of the thinking process,**
-**involves imposing meaning** (finding structure in apparent disorder, and
-**effortful** (considerable mental work is involved in complex elaborations and judgements).

(Resnick, 1987, p.3)

Many aspects of powerful thinking are common across situations and disciplines. If these general thinking skills can be delineated, and if effective ways of instruction are implemented to teach these skills, then a potential exists for a relatively narrow instructional effort to effect wide positive learning results. However, cognitive research clearly demonstrates the central role that specific content area knowledge plays in reasoning, thinking and learning in general. This suggests that the teaching of thinking within specific subject area disciplines, hoping for transfer of these general thinking skills to other disciplines may be a promising approach (Resnick, 1987).

Metacognitive skills are cited by Resnick (1987) as one of the processes that appears repeatedly in analyses of complex task performance. Her description of these skills is in congruence with those previously described above. Metacognitive skills play an "executive" or regulatory role in thinking, with their being used to keep track of understanding; to initiate review of

rehearsal activities as required; and to deliberately organize and control attention and/or other resources to aid in the learning process.

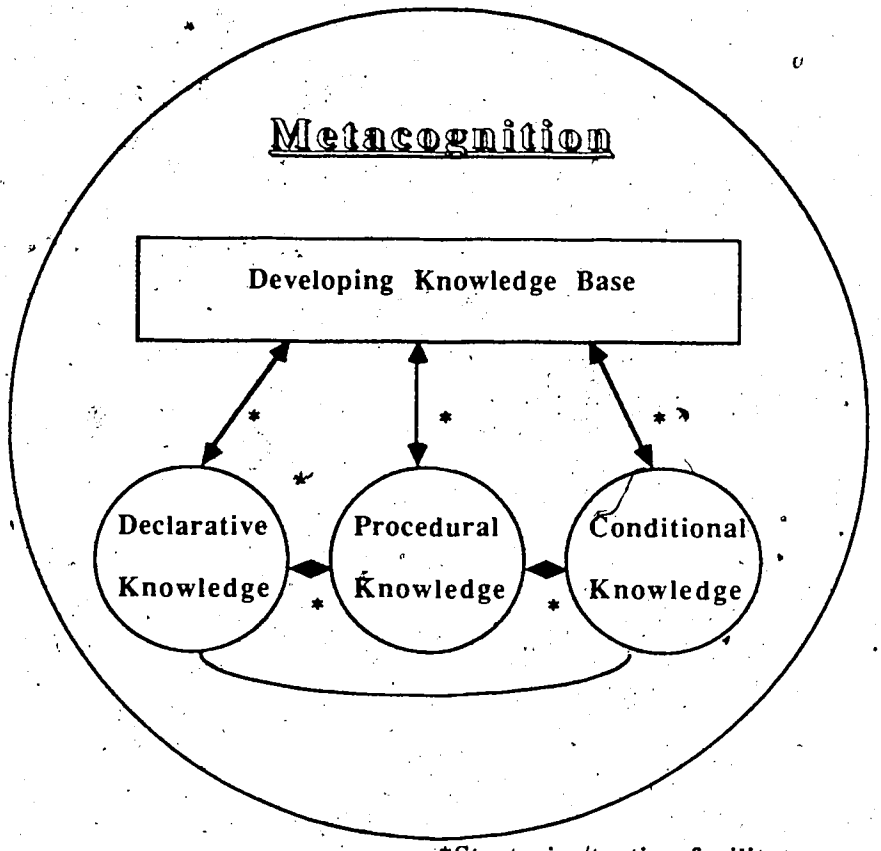
Synopsis of What We Know About Learning/Thinking

As is apparent from the above attempt to address the question of "What is thinking?" there is little agreement as to what the underlying processes of thinking are. Further, due to the complex and interactive nature of thinking, perhaps this reductionist approach is not an appropriate means of analysis (Nickerson, 1988).

In spite of our present lack of knowledge in the area of thinking, when designing curriculum for the teaching of learning/thinking, there must be a starting point; a framework to follow as a blueprint to ensure that the "full range" of thinking skills are being addressed. Perhaps for this purpose the thinking skill "taxonomies" are helpful. However, in both the *Dimensions for Thinking* and the *Thinking Skills Throughout the Curriculum* texts, the rationale for choosing the specific skills and processes presented while excluding others is not clear, bringing into question the validity of the lists.

In synthesizing the literatures on both learning and thinking, it appears that only two major unifying strands run through the complex learning/thinking tapestry: 1) The central importance of metacognition, and, 2) the role of knowledge in the development of thinking. This points to the importance of continued research and program development emphasizing these two areas. The model presented below (see figure 3) is a visual representation of the axiomatic role of metacognition interacting with the acquisition of differing knowledge bases as the teaching of learning/thinking takes place.

Figure 3



The development of effective educational cognitive education programs *should* reflect what is known about learning and thinking. This knowledge, if applied, would serve as a guide as to both **how** the material should be taught and **what** thinking skills should be emphasized.

A Selected Review of Programs Designed to Teach Thinking Skills

Do approaches and programs that have been developed to teach thinking in the classroom presently in place reflect the above current conceptualizations of thinking? Some recently published programs do appear to be in line with these new notions. [i.e. *McREL Thinking Skills*

program/Tactics for Thinking (Marzano & Arrendondo, 1985, 1986), and *Informed Strategies for Learning* (Paris, 1986)].

However, on the whole, there doesn't appear to be clear agreement between current theory and instructional practice. Programs differ widely in terms of scope, skill development, age/grade suitability, instructional methodology, goals, training costs and curricular integration (Black, 1986; Chance, 1986; Costa, 1985a; Nickerson, Perkins & Smith, 1985).

Rather than reflect the **current** conceptualizations of thinking, these program differences seem largely to be a product of the variation of theoretical points of view of the authors. Their positions were influenced by **the context** (i.e. time period, prominent theories of mentors, etc) in which they and their colleagues collaborated, including their perceptions of the intellectual needs of the populations for which the programs were originally designed. A sampling of programs, designed for differing student populations, are skeletally described, without evaluation, to illustrate this perspective

FIE-Identifying and Modifying Basic Thinking Operations or Processes

Feuerstein's Instrumental Enrichment (FIE) (Feuerstein, 1980), is based upon his theory of structural cognitive modifiability via mediated learning experiences. The influence of Piaget is clearly seen in the theory, for it is based upon the premise that children can learn from the environment (Bower & Hilgard, 1975) but, unlike Piaget, the emphasis is on the importance of **mediation** of the child's learning by an adult (Savell, Twohig & Rachford, 1986; Link, 1985; Mulcahy, Peat, Andrews & Mancini, 1987; Woolsey, Pace, Reid & Mulcahy, 1988) rather than the child's direct interaction with the environment. This mediation takes the form of intentional transformation, reordering, organizing, grouping , or framing of the environmental stimuli that transcends the immediate stimuli and reveals new meaning and insights to the child. Poor or inadequate mediated learning experience leads to cognitive deficiencies related to the three phases of information process: input, elaboration, and output. Feuerstein has described as many as 21 of such deficiencies including impulsivity, lack of regard for precision and accuracy, inability to

recognize and define problems, etc. (Mulcahy, Andrews, & Peat, in press). (For detailed reviews of the effectiveness of FIE see, Bransford, et al, 1985; Savell, Twohig & Rachford, 1986; Shayer & Beasley, 1987.) Since at the adolescent stage, success experiences with 'school-like' tasks would be minimal for the target population, in order to motivate these pupils, Feuerstein chose to design his materials using an 'out of content' approach. Once the learning/thinking principles are acquired, they are then 'bridged' back into the school environment (Mulcahy, Peat, Andrews & Mancini, 1987).

Feuerstein's neo-Piagetian theoretical perspective was rooted by his working with Piaget in Switzerland, at that time in the forefront of educational thought. The theory of structural cognitive modifiability, with a listing of cognitive deficiencies grew out of Feuerstein's work with 'culturally deprived' adolescents who had immigrated to Israel from North Africa after the Second World War. According to traditional IQ tests they were categorized as mentally retarded. Feuerstein reinterpreted this poor performance not as a fixed attribute, but as indicative of cognitive deficiencies due to their extreme deprivation (i.e. lack of mediated experiences) during the war and therefore modifiable.

Meekers' SOI-Diagnostic/Prescriptive Remediation and Enrichment Plan

Drs. Mary and Robert Meeker have developed a comprehensive series of remediation and enrichment plans based upon Guilford's (1967, 1971) "Structure of Intellect" Model (Meeker, 1981). Like FIE it also sets out to improve the underlying processing skills of learners. Each student's 26 intellectual abilities are individually profiled, and from this profile a prescriptive remediation and/or enrichment plan is formulated. The exercises are extra-disciplinary. The intended audience is from pre-school to adult (Black, 1986). This program strongly reflects the author's perspectives on intelligence and views all pupils as needing to be proficient in all of the multiple mental operations identified by the Guilford Model (Meeker, 1985).

Deschler and Associates- Strategy Intervention for Learning Disabled Adolescents

Deschler and his associates (Deschler et al, 1983; Deschler & Schumaker, 1986) strategy intervention targets the similar age group as FIE. The approach reflects the current conceptualizations of the learning disabled as strategy inefficient or deficient; as needing explicit teaching for transfer; and as requiring drill and repetition to establish a strategic knowledge base. The intervention program does not have as its goal the remediation of underlying cognitive deficits, but rather the survival of the LD adolescents in the regular stream, using regular content. Its development also reflects the current mainstreaming push in North America. A motivational component is taken into account in the 8-step teaching methodology, rather than using 'out-of-content' materials, as does FIE and Meeker's SOI Intervention.

DeBono's CoRT

The aim of the CoRT program (deBono, 1980) is to help students become adults who plan, choose, decide, construct and take initiative; in short to make things happen (Chance, 1986). DeBono sees skillful thinkers as not necessarily being intelligent and vis versa; a less intelligent person who has good thinking skills has the potential to out-think a more intelligent individual. His views on thinking were developed from an experiential base integrated with his training in systems behavior. The conclusions about thinking were arrived at by deBono after working for a number of years as a systems consultant with architects, designers, scientists, lawyers, engineers, etc. He found that rather than thoroughly examining an issue, the norm was for people to use their logical thinking to defend an already established conclusion or position. The CoRT program attempts to correct this practice. The skill areas emphasized are:

Figure 4

1) **Breadth**: emphasizes diverse ways of thinking
2) **Organization**: helps direct attention systematically and effectively to a situation without losing focus
3) **Interaction**: emphasizes matters of evidence and argument
4) **Creativity**: presents ways of generating multiple ideas about a subject, and then evaluating these ideas
5) **Information and Feeling**: affective matters are addressed as well as a review of previously covered themes
6) **Action**: a problem attacking unit

(Nickerson, Perkins & Smith, 1985).

DeBono is a pragmatist who views thinking as a skill that can be improved by practice in the various operations presented in the CoRT program until they form a habit. These procedures are presented through the medium of a series of extra-curricular lessons centred around various deBono thinking "tools". An example of one of these tools is the PMI (Plus, Minus, Interesting) acronym which is used as a framework to guide examination of all aspects of an issue. These tools are purposefully simple in design, and described by deBono as 'rigorous' in that they survive intact when passed on from teacher to pupil or from person to person, and are "usable by teachers who represent a wide range of teaching talents, not just the highly gifted or qualified" (deBono, 1985). In Canada, the CoRT program is usually implemented in programs for the gifted, although it has been administered to students "from age 8 to 22, and from slow to bright groups" (Nickerson, Perkins & Smith , P.215).

Productive Thinking

The Productive Thinking Program (Covington, et al, 1974) was published after extensive field testing in the United States with more than ten thousand elementary children, hundreds of teachers, and dozens of schools. The program was designed with the goal of remediating what was

perceived as a serious deficiency in the 'productive thinking' abilities of American students. Productive thinking is defined by the authors (Covington, et al, 1974) as " the use of the mind in and effective, intelligent and creative way directed toward the solution of a problem" (p.2).

Productive thinking involves the use of five kinds of general thinking skills, which can be improved by instruction in general strategies or "thinking guides". These five skills are: 1) discovering and formulating problems, 2) organizing and using information, 3) generating ideas, 4) evaluating and improving ideas, and 5) creating new perspectives.

Covington and his colleagues appear to have three basic concepts at the foundation of the program design. First, that in order to be mastered, the general strategies must be taught explicitly and systematically, with much practice in meaningful problem solving. Second, students need to be convinced that they can improve their thinking, and that thinking can be an enjoyable occupation, worth being engaged in. Third, that there is a specific set of cognitive skills which, when developed, lead to more effective thinking. Both skills and dispositions to use the skills are considered to be of equal importance. The ideas about the nature of the thinking skills come from the Gestalt tradition focusing primarily on idea fluency, and restructuring or redesigning problems (Chance, 1986; Nickerson, Perkins & Smith, 1985; Polson & Jeffries, 1985).

The self-instructional student materials are in the form of a series of 15 comic book stories which present a wide array of problems to the pupils. Questions requiring a written answer, are interspersed throughout the books. A set of problems follow each lesson in order to provide additional practice in problem solving. The program is designed to be within the abilities of most fifth- and sixth-grade level pupils, but is also recommended as a remedial program for slow-learners, or an enrichment program for the gifted (Chance, 1986; Nickerson, Perkins & Smith, 1985).

The programs depicted above then, exemplify the wide range of theoretical positions of the authors and their differing views of student needs. Program developers, tend to either emphasize the development of the underlying processes of thinking or the explicit teaching of strategies to use in the thinking process. Motivation appears to be emphasized in the program design when dealing

with those with learning problems, but is de-emphasized or appears as "dispositions" when dealing with "regular" pupils. Both in-content and out-of-content approaches are used. In short, the diversity of programs reflects the complexity and our present lack of knowledge regarding teaching the learning/thinking process.

SPELT (Strategies Program for Effective Learning/Thinking)

In 1984 when the SPELT program was first envisioned and written, many of the sources, particularly on the infusion of thinking skills within curriculum, presented above, did not exist. It seems that the area of cognitive education, with its apparent short informational half-life stands as a testimony for the teaching of efficient knowledge acquisition.

Throughout the last four years, we have been encouraged by the teacher responses to SPELT and the on-going research results (Mulcahy et al, 1986, 1987, 1988; Mulcahy, Andrews, and Peat. in press). However, as new theoretical information coupled with qualitative and quantitative empirical data is received, revision becomes necessary. Effective program development requires on-going collaboration between theoreticians, researchers, and the field in order to effectively close the research-practice gap. The Cognitive Education Project, one aspect being the SPELT Program, is an attempt to do this.

Description of the SPELT Program

The SPELT program is presently packaged in the form of a binder style Teachers' Manual. This structure is meant to facilitate users being able to easily insert supplemental materials, and allowing them to easily access the 'overhead' transparency master pages interspersed throughout the document. The binder is divided into two major sections; Part One presenting the theoretical framework and background, and Part Two documenting the three-phase Instructional Model with recommended learning strategies. The second part is further divided into three sections, each one illustrating a phase of the instructional model. The following section summarizes the SPELT

Instructional Model to provide a basis for its critique which follows. [Further detail on the model is provided elsewhere (Chapter 2, this volume)].

SPELT Instructional Model

The SPELT instructional approach has three major components: a general teaching style or orientation; the teaching of both recommended and teacher-generated strategies; and teaching toward student control and generation of learning/thinking strategies.

General teaching style refers to the orientation whereby the teacher's goal in all planning and instruction is to involve the student actively in the learning process. Among the principle hallmarks of this orientation are: raising student's awareness about their own cognitive processes and how to control them; leading students to discover rather than revealing or teaching facts to them; and constantly challenging students to be critical, systematic, and strategic in their behavior and attitude to learning and problem solving. In this orientation, the teacher seeks to use instructional techniques that constantly cue, demonstrate, and reinforce the use of learning/thinking strategies (Mulcahy & Marfo, 1987).

The instructional model (see Figure 1, Chapter 2, this volume), is comprised of three phases. In describing the model, first the general, then the specific goals will be outlined, followed by an explanation of the methodologies employed to achieve the stated goals.

General goals.

The SPELT Instructional Model is described by the authors as translating contemporary cognitive psychological theory and research into a practical and easy-to-implement instructional program (Mulcahy et al, 1986). In broad terms, the goals of SPELT include training students:

a) to become active learners, thinkers, and problem solvers,

b) to become more planful and strategically efficient in their approach to learning;

c) to become independent learners, and,

d) to be aware of, and to control their own thinking processes (metacognitive empowerment) (Mulcahy, Marfo Peat & Andrews, 1984, 1987).

Specific goals of each phase.

A progression from the lowest level of strategy acquisition (acquisition through teacher imposition-Phase I) to the highest level of acquisition (acquisition through self-generation-Phase III) is involved in the SPELT Instructional Model continuum. This approach has been recommended or alluded to by various authors (Derry and Murphy, 1986; Marzano et al, 1988; Rigney, 1978). Phase I teaching consists of the presentation of a number of recommended and teacher generated strategies designed to expose the students to the fact that cognitive strategies exist (metacognitive awareness) and to illustrate that organized, goal-directed and efficient use of learning strategies increases their ability to acquire, think about, remember, retrieve, express and apply, information and ideas (Jones, Palincsar, Ogle, & Carr, 1987; Marzano et al, 1988; Pressley & Levin, 1983). As the students practice these strategies in the content areas, active involvement and interaction with the material to be learned is facilitated. This extended exposure to, and practice using these strategies begins the process of consciously building a personal repertoire of useful strategies for the students which serve as tools for learning new material (metacognitive empowerment) (Ellis, Lenz, & Sabornie, 1987a; 1987b). Phase I instruction is viewed as the systematic establishment of student's strategic knowledge base which lays the groundwork for Phase II and III teaching. During Phase I, the source of control for strategy use is with the teacher. Remaining within this phase, however, leaves little room for students to participate in the determination of which strategies are appropriate for what purposes, or for including previously developed personal strategies (Costa, 1984; Derry & Murphy, 1986; Doctorow, Wittrock & Marks, 1978). This teacher imposed approach is **only the initial starting point** of SPELT instruction; in fact, staying within this phase runs counter to the previously stated goals, namely, to facilitate active participation of the students in the learning process and for students to become independent learners (Marzano et al, 1988; Mulcahy et al, 1986; Nickerson, Perkins & Smith, 1985).

Unresolved Issues in Cognitive Education

In spite of, or perhaps because of, the recent explosion of new information in the rapidly developing, dynamic field of cognitive education, there are many unresolved issues. Because of this, it is an exciting, challenging area in which to work. The issues we attempt to grapple with in SPELT's on-going development, are parallel to the problems other researchers, theoreticians and program designers are also facing. What follows is a brief overview of these major issues.

'In-Content' or 'Out-Of-Content' Approach?

It is possible that there is no one correct approach for teaching thinking. This perspective suggests that an 'out-of-content' approach may be most appropriate for some individuals, such as pre-school youngsters, culturally deprived adolescents, or some "working adults". For others, perhaps average achieving students, learning disabled and/or college students, an 'in-content' mode might be most appropriate. The best solution may be to implement programs on the basis of a continuum, beginning out-of content and then gradually integrate the explicit teaching of learning/thinking skills into the curriculum context. Using this approach , it would be necessary to make allowances for movement in and out of content at any level, according to need (for example, pre-school, elementary, high school, vocational and college/university) (Mulcahy, Andrews, & Peat, in press).

Presently there seems to be widespread support for using content material as the instructional vehicle (Bransford, Sherwood, Vye, & Rieser, 1986; Brandt, 1988; Chambers, 1988; Chance, 1986; Glaser, 1984; Mulcahy et al, 1986; Presseisen, 1988; Resnick, 1986). The question of which direction is best however, has not yet been fully answered, for there is little longitudinal, comprehensive research data available comparing the differential effects of these these differing procedures with students of various ability and age levels and with control groups (Harris, 1988; Nickerson et al, 1985).

Motivational Components

In the brief description of available programs above, some seemed to emphasize the motivational component in their design, particularly those working with exceptional groups, while others de-emphasized this variable. Pressley, (1987), states that there is a "great need in general for re-engineering classrooms so that motivation is enhanced" (p.51). A few researchers have begun to examine the role of motivation in the teaching of learning/thinking with various student populations (Paris & Oka, 1986; Mulcahy et al, in press), but data in this area is sparse. This is of primary importance, particularly for those with learning difficulties for "emotional and motivational variables are central to some (if not all) learning disabilities, either as initial causes or as factors that exacerbate problems that are based on neurological deficits" (Deci & Chandler, 1986, p. 587.). Systematic, comprehensive research in this area is sorely needed to facilitate the re-design of classrooms to enhance motivation.

Assessment

Resnick (1987) identifies the development of appropriate evaluation strategies as an important challenge facing the movement for improving the teaching of thinking. Mastery performance (i.e. exercises similar to the program itself) is the most common form of assessment reported when evaluating various cognitive education programs. Although a first step in evaluation, this form of assessment tells us little about the ability of the programs to effect thinking performance beyond the course of the program (i.e generalization).

Assessment of cognitive ability should place greater emphasis upon cognitive processes and strategies that underlie learning and performance (Mulcahy & Marfo, 1987). Although there are promising efforts being made to develop standardized strategy and process measures (Biggs, 1987; Feuerstein, Rand, & Hoffman, 1979; Mulcahy et al in press; Paris & Oka, 1986) to both evaluate program effectiveness and to establish instructional priorities, much more work is needed in this area.

Most evaluation taking place in classrooms is based on a product model of teaching. This is inconsistent with present conceptualizations of learning as described in the initial part of this paper. If teachers are expected to teach the *process* of learning/thinking, then they must also be trained in the skills of developing and administering classroom based process measures(Weiner, 1986).

Inservice/Preservice Teacher Training

If, with the implementation of improved program effectiveness measures, the evaluations of learning/thinking strategy teaching continue to prove to be positive, there will be a need to incorporate this type of teaching orientation into both preservice and inservice training for teachers. To ensure optimum impact and broad application, it is imperative that all teachers, not only specially designated ones (i.e. special education) be trained in this orientation. This way, all teachers would be better prepared to work with all categories of children encountered in the classroom (Mulcahy, Andrews, & Peat, in press). Governments, Universities, and Teacher Training Institutions cannot afford to lag behind in training teachers to be systematic, effective thinkers and problem solvers with the ability and methodology to, in turn, influence the thinking and problem solving skills of their students (Brandt, 1988; Sternberg, 1987; Wasserman, 1987).

1. Portions of this chapter have been accepted for publication:

a) Mulcahy, R. F., Darko-Yeboah, J., Andrews, J., Peat, D.W., Clifford, L., & Norman, C. (in press). Cognitive Education Project, Progress Report: Year 3. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

b) Mulcahy, R. F., Peat, D. W., & Andrews, J. (In Press). Learning-thinking strategy research: Applications for classroom teaching. In J. B. Biggs (Ed.). Learning Processes and Teaching Contexts. Australian Council for Educational Research.

c) Alberta Education (in press). A framework of thinking skills. Edmonton, author.

REFERENCES

Alberta Education. (1985, June). Secondary education in Alberta: A policy statement. Edmonton, author.

Alberta Education. (1987). Problem solving in mathematics: Focus for the future. Edmonton, author.

Alberta Education. (1987, March). Students' thinking: Developmental framework, cognitive domain. Edmonton, author.

Alberta Education. (1987, May). Essential concepts, skills and attitudes for grade 12: Second draft. Edmonton, author.

Alberta Education. (1987, June). Report of the committee on thinking skills: Working draft. Edmonton, author.

Alberta Education. (1988). Teachers Resource Manual: Language Arts 16 Edmonton, author.

Anderson, T. H. (1980). Study strategies and adjunct aids. In R. J. Spiro, B. C. Bruce & W. F. Brewer (Eds.) Theoretical issues in reading comprehension: Perspectives from cognitive psychology, linguistics, artificial intelligence and education. Hillsdale, NJ: Erlbaum.

Andrews, J. (1984). An exploration of study strategies used by spelling disabled children: A qualitative comparison of three teaching approaches. unpublished Masters Theses, University of Alberta, Edmonton, Alberta.

Bachor, D., G. (1985). Questions for and by the learning disabled student. In J. F. Cawley (Ed.). Cognitive strategies and mathematics for the Learning Disabled. Rockville, MD: Aspen, 183-203.

Belmont, J. M., Butterfield, E. C., & B Ferretti, R. P. (1982). To secure transfer of training instruct self-management skills. In D. K. Detterman & R. J. Sternberg (Eds.), How and how much can intelligence be increased. Norwood, NJ: Ablex.

Biggs, J. (1987). Student approaches to learning and studying. Melbourne, Australia: Australian Council for Educational Research.

Black, S. P. (1986, August). Implementing a local thinking skills program. Materials from ASCD workshop. Williamsburg, VA.

Bower, G. H., & Hilgard, E. R. (1975). Theories of learning (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.

Bransford, J. & Stein, D. (1983). The ideal problem solver. Van Nays, CA: W. H. Freeman.

Bransford, J., Arbitman-Smith, Stein, B. S., & Vye, N. J. (1985). Improving thinking and learning skills: An analysis of three approaches. In J.W. Segal, S.F. Chipman, & R. Glaser (Eds.), Thinking and learning skills: Relating instruction to basic research: Vol. 1 (pp. 133-206). Hillsdale, NJ: Lawrence Erlbaum.

Bransford, J., Sherwood, R., Vye, N., & Rieser, J. (1986). Teaching thinking and problem solving. American Psychologist, 41 (10), 1078-1089.

Brandt, R. (1988). On teaching thinking: A conversation with Art Costa. Educational Leadership, 45, (7), 10-13.

Brophy, J. (1986). Teacher influences on student achievement. American Psychologist, 41 (10), 1069-1077.

Brophy, J. E. & Good, T. L. (1986) Teaching behavior and student achievement. In M. C. Wittrock (Ed.). Handbook of research on teaching (3rd ed.). New York: Macmillan.

Brophy, J. & Porter, A. (1988, May). Synthesis of research on good teaching: Insights from the work of the institute for research on teaching. Educational Leadership, 74-85.

Brown, A., L. & Campione, J. C. (1977). Training strategic study time approtionment in educable retarded children. Intelligence, 1, 94-107.

Brown, A., L. & Campione, J. C. (1986). Psychological theory and the study of learning disabilities. American Psychologist, 10, (14), 1059-1068.

Chambers, J. H. (1988). Teaching thinking throughout the curriculum - Where else? Educational Leadership, 45, (7), 4-6.

Chance, P. (1986). Thinking in the classroom: A survey of programs. New York: Teachers College Press

Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), Advances in the psychology of human intelligence (Vol.1.). Hillsdale, NJ: Erlbaum.

Clark, C., M. & Peterson, P., L. (1986). Teachers' thought processes. In M. C. Wittrock (Ed.), Handbook of research on teaching (pp. 255-296). New York: Macmillan.

Costa, A. (1984, November). Mediating the metacognitive. Educational Leadership. pp.57-62.

Costa, A. (1985a). Developing minds: A resource book for teaching thinking.. Alexandria, VA: ASCD.

Costa, A. (1985b). Teaching for, of, and about thinking. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking.. Alexandria, VA: ASCD.

Costa, A. (1985c). Teacher behaviors that enable student thinking. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking. Alexandria, VA: ASCD.

Covington, M. V., Crutchfield, R. S., Davies, L., & Olton, R. M. The productive thinking program: A course in learning to think. Columbus, OH: Charles E Merrill.

Cuban, L. (1984). Policy and research dilemmas in the teaching of reasoning: Unplanned designs. Review of Educational Research, 54, 655-681.

Dansereau, D. F.,(1985). Learning strategy research. In J. Segal, S. Chipman & R. Glaser (Eds.) Thinking and learning skills volume 1: Relating instruction to research Hillsdale, NJ: Lawrence Erlbaum.

Dellandrea, J. (1988). An evaluation of two learning/thinking strategy programs. Unpublished Doctoral Dissertation, University of Alberta.

deBono, E. (1980). Teaching thinking. New York: Penguin Books.

deBono, E. (1985). The CoRT thinking program. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking. Alexandria, VA: ASCD.

Deci, E. L. & Chandler, C. L. (1986). The importance of motivation for the future of the LD field. Journal of Learning Disabilities, 19, (10), 587-594.

Derry, S. J. & Murphy, D. A. (1986). Designing systems that train learning ability: From theory to practice. Review of Educational Research, 56. 1-39.

Deschler, D. D., Warner, M. M., Schumaker, J. B., & Alley, G. R. (1983). Learning strategies intervention model: Key components and current status. In J. P. McKinney & L. Feagans (Eds.), Current topics in learning disabilities. Norwood, NJ: Ablex Publishing Corp.

Deschler, D. & Schumaker, J. (1986). Learning strategies: An instructional alternative for low-achieving adolescents. Exceptional Children, 52, (6). 583-590.

Doctorow, M., Wittrock, M.C., & Marks, C. (1978). Generative Processes in Reading Comprehension. Journal of Educational Psychology, 70 (2), 109-118.

Ellis, E. S., Lenz, B. K., & Sabornie, E. J. (1987a). Generalization and Adaptation of learning strategies to natural environments: Part 1: Critical agents. RASE, 8,(1) 6-20.

Ellis, E. S., Lenz, B. K., & Sabornie, E. J. (1987b). Generalization and Adaptation of learning strategies to natural environments: Part 2: Research into practice. RASE, 8,(2) 6-23.

Ennis, R. H. (1985). Goals for critical thinking curriculum. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking. Alexandria, VA: ASCD.

Feuerstein, R., Rand, Y., & Hoffman, M. (1979). Dynamic assessment of retarded performers: The Learning Potential Assessment Device: theory, instruments, and techniques. Baltimore: University Park Press.

Feuerstein, R. (1980). Instrumental enrichment: An intervention program for cognitive modifiability. Baltimore: University Park Press.

Flavell, J. H. (1979). Metacognition and cognitive monitoring. American Psychologist, 34, 906-911.

Gagne´, R. M. (1977). The conditions of learning (3rd. ed.). New York: Holt, Rinehart, and Winston.

Gagne´, R. M. (1985). The conditions of learning and theory of instruction. New York: Holt, Rinehart and Winston.

Gagne´, R. M. & Briggs, L. J.(1979). Principles of Instructional Design (2nd. ed.). New York: Holt,

Glaser, R. (1984). Education and thinking: The role of knowledge. American Psychologist, 39, 93-104.

Goldberg, M. & Harvey, J. (1983). A Nation at Risk: The report of the National Commission on Excellence in Education. Phi Delta Kappan, 65, (1). 14-18.

Guilford, J. P. (1976). The early identification of educationally at risk children. In K. Weddell & E. C. Raybould (Eds.), The early identification of educationally 'at risk' children. Birmingham, England: School of Education, University of Birmingham.

Guilford, J. P., & Hoepfner, R. (1971). The analysis of intelligence. New York: McGraw-Hill.

Hallahan; D. P., Hall, R. J., Ianna, S. O., Kneedler, R. D., Lloyd, J. W., Loper, A. B., Reeve, R. E. (1983). Summary of research findings at the University of Virginia learning disabilities research institute. Exceptional Education Quarterly 4 (1), 95-111.

Harris, K. R. (1988, April). What's wrong with strategy intervention research: Intervention integrity. Short handout to accompany part of the symposium presentation, Self-regulated learning III: Research, practice, and policy issues relevant to instruction aimed at developing academic self regulation. New Orleans: AERA

Jones, B. F. (1986, April). Quality and equality through cognitive instruction. Educational Leadership. pp. 6-11.

Jones, B.F., Palincsar, A. S., Ogle, D. S., & Carr, E. G., (1987). Strategic teaching and learning: Cognitive instruction in the content areas. Alexandria, VA: Association for Supervision and Curriculum Development.

Joyce, B. & Weil, M. (1986). Models of teaching.(3rd. ed.) Englewood Cliffs, NJ: Prentice-Hall, Inc.

Lefrancois, G. R. (1988). Psychology for teaching (6th.ed.). Belmont, CA: Wadsworth Publishing Company.

Link, F. R. (1985). Instrumental Enrichment. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking. Alexandria, VA: ASCD.

Lipman, M., Sharp, A., & Oscanyan, F. (1980). Philosophy in the classroom, 2nd ed. Philadelphia: Temple University Press.

Lupart, J., & Mulcahy, R. (1983, June). Text driven vs. conceptually driven processing in good and poor readers: A developmental perspective. Canadian Psychological Association Annual Meeting, Winnipeg, Manitoba.

Maher, C. H. & Schwebel, M. (1986). Facilitating cognitive development: Issues and implications. In M. Schwebel & C. A. Maher (Eds.) Facilitating cognitive development: International perspectives, programs and practices. New York: The Haworth Press.

Marzano, R.J. , & Arrendondo, D. E. (1985). McREL thinking skills teachers manual: Field test copy. Aurora, CO: Mid-continent Regional Educational Laboratory

Marzano, R.J. , & Arrendondo, D. E. (1986). Tactics for thinking: teachers manual. Aurora, CO: Mid-continent Regional Educational Laboratory

Marzano, R. J., Brandt, R. S., Hughes, C. S., Jones, B. F., Presseisen, B. Z., Rankin, S. C., & Suhor, C. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, VA: Association for Supervision and Curriculum Development.

McKeachie, W., J. (1987). Cognitive skills and their transfer: Discussion. International Journal of Educational Research, 11 (6), 707-712.

McTighe, J. & Schollenberger, J.(1985). Why teach thinking: A statement of Rationale. In A. Costa (Ed.) Developing Minds: A resource book for the teaching of thinking. Alexandria, VA: Association for Supervision and Curriculum Development.

Meeker, M. N. (1981). Using SOI test results: A teachers' guide. El Segundo, CA: SOI Institute

Meeker, M. N. (1985). SOI. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking. Alexandria, VA: ASCD.

Meichenbaum, D. (1986). Metacognitive methods of instruction: Current status and future prospects. In M. Schwebel & C. A. Maher (Eds.) Facilitating cognitive development: International perspectives, programs and practices. New York: The Haworth Press.

Mulcahy, R. (1980). Memory: Some selective aspects. In R. Jarmin, (Ed.) Issues in developmental disabilities. University Microfilms International.

Mulcahy, R. H., Marfo, K., Peat, D. W. (1984). SPELT: A Strategies program for effective learning and thinking-Research edition. (Available from the Cognitive Education Project, Department of Educational Psychology, University of Alberta).

Mulcahy, R. H., Marfo, K., Peat, D. W., & Andrews, J. (1986). SPELT: A Strategies program for effective learning/thinking-Inservice Training Materials. (Unpublished materials: The Cognitive Education Project, Department of Educational Psychology, University of Alberta).

Mulcahy, R. H., Marfo, K., Peat, D. W., Andrews, J., & Clifford, L. (1986). Applying cognitive psychology in the classroom: A learning/thinking strategies instructional program. Alberta Psychology, 15, (3), 9-12.

Mulcahy, R., Darko-Yeboah, J., Peat, D.,& Andrews, J. (October, 1987). Barrhead report on the SPELT program. 36 pages. (Available from the Cognitive Education Project, Department of Educational Psychology, University of Alberta).

Mulcahy, R. H., Marfo, K., Peat, D. W., & Andrews, J. (1987). SPELT: A Strategies program for effective learning/thinking-Inservice Edition. (Available from the Cognitive Education Project, Department of Educational Psychology, University of Alberta).

Mulcahy, R. H., Marfo, K. (1987). Assessment of cognitive ability and instructional programming with native Canadian children: A cognitive processes perspective. In L. L. Stewin & J. H. McCann (Eds.), Contemporary Educational Issues The Canadian Mosaic (pp. 157-177). Toronto, Ont: Copp Clark Pitman.

Mulcahy, R., Peat, D., Andrews, J., & Mancini, G. (1987) Learning Thinking Strategies Instruction-Instrumental Enrichment. Instructional video tape produced by Instructional Technology Centre, University of Alberta.

Mulcahy, R., Cho, S., Peat, D., Marfo, K., Clifford, L., & Henderson, H. (March,1986). A longitudinal examination of Cognitive Education: A Progress Report. 60 pages. University of Alberta, Cognitive Education Project.

Mulcahy, R., Clifford, L., Peat, D., Marfo, K., Norman, C.,& Cho, S. (June, 1987). A longitudinal evaluation of Cognitive Education: Second Progress Report. 150 pages. University of Alberta, Cognitive Education Project.

Mulcahy, R. F., Darko-Yeboah, J., Andrews, J., Peat, D., Marfo, K., Clifford, L., Cho, S., & Norman, C. (1988). Cognitive Education Project, Executive Summary: Year 3. University of Alberta, Cognitive Education Project.

Mulcahy, R. F., Andrews, J., & Peat, D. (in press). Cognitive education: A longitudinal evaluation. In C. K. Leong & B. S. Randhawa (Eds.). Literacy and Cognition: Theory, Research and Instructional Implications. New York: Plenum.

Nickerson, R. S.(1986). Why teach thinking? In J. B. Baron & R. J. Sternberg (Eds.) Teaching Thinking Skills: Theory and Practice. New York: W.H. Freeman and Company.

Nickerson, R. S. (1988). Dimensions of thinking: A critique. Unpublished manuscript. Cambridge, MA: Bolt Baranek and Newman Laboratories, Inc.

Nickerson, R. S. (in press). On improving thinking through instruction. Prepared for Review of Research in Education.

Nickerson, R. S., Armbruster, B., Begab, M., Cox, B., Feuerstein, R., Gothold, S., Greenhalgh, C., Millard, W., Paris, S., Pearson, P., Rosotto, G., Smith, R. G., Ward, J., & Wittrock, M. (1985, winter). Report from the excellence in schools task force on learning strategies and thinking skills. Outcome (4), 2.

Nickerson, R. S., Perkins, D. N., & Smith, E. E. (1985). The teaching of thinking. Hillsdale, NJ: Erlbaum.

Norris, S. P. (1985, May). Synthesis of research on critical thinking. Educational leadership, 40-45.

Palincsar, A. S. & Brown, D. A. (1987). Enhanced instructional time through attention to metacognition. Journal of Learning Disabilities, 20, 66-75.

Paris, S. g. & Oka, E. R. (1986). Children's reading strategies, metacognition, and motivation. Developmental Review, 6, 25-56.

Pearson, P. D. & Johnson, D. D. (1978). Teaching reading comprehension. Toronto: Holt, Rinehart and Winston.

Polson, P. G., & Jeffries, R. (1985). Instruction in general problem-solving skills: An analysis of four approaches. In J. Segal, S. Chipman & R. Glaser (Eds.) Thinking and learning skills volume 1: Relating instruction to research Hillsdale, NJ: Lawrence Erlbaum.

Presseisen, B. Z., (1985). Unlearned lessons: Current and past reforms for school improvement. Philadelphia: The Falmer Press.

Presseisen, B. Z., (1987). Thinking skills throughout the curriculum: A conceptual design. Bloomington, IN: Phi Lambda Theta.

Presseisen, B. Z., (1988). Avoiding the battle at curriculum gulch: Teaching thinking and content. Educational Leadership, 45, (7), 7-8.

Pressley, M., Levin, J.R. (Eds.) (1983). Cognitive strategy research. New York: Springer-Verlag.

Pressley, M., Goodchild, F., Fleet, J., Zajchowski, R. (1987). What is good strategy use and why is it hard to teach?: An optimistic appraisal of the challenges associated with strategy instruction. Handout to accompany Michael Pressley's AERA talks., April, Washington, DC.

Resnick. L. B. (1987). Education and Learning to Think. Washington, DC: National Academy Press.

Rigney, J. W. (1978). Learning strategies: A theoretical perspective. In H. F. O'Neil, Jr. (Ed.), Learning Strategies. New York: Academic Press.

Sanacore, J. (1984). Metacognition and the improvement of reading: Some important links. Journal of Reading, 30, 706-713.

Savell, J. M. Twohig, P.T. & Rachford, D. L. (1986). Empirical status of Feuerstein's "Instrumental Enrichment" (FIE) Technique as a method of teaching thinking skills. Review of Education Research, 56, (4), 381-409.

Scardamalia, M., and Bereiter, C. Research on written composition. In M. C. Wittrock (Ed.), Handbook of research on teaching. New York: Macmillan.

Schneider, W. (1985). Developmental trends in the Metamemory-memory behavior relationship: An integrative review. In Metacognition, cognition, and human performance, volume 1: Theoretical perspectives. Toronto, Academic Press.

Schoenfeld, A. H. (1985). Mathematical Problem Solving. Toronto: Academic Press.

Scott, M. E. (1988, spring). Learning strategies can help. Teaching Exceptional Children, 30-33.

Shaver, M. & Beasley, F. (1987). Does instrumental enrichment really work? British Educational Research Journal, 13, (2), 101-119

Shuell, T. J. (1986, winter). Cognitive conceptions of learning. Review of Educational Research, 56, (4), 411-436.

Snow, R. E. (1982). The training of intellectual aptitude. In D. K. Detterman & R. J. Sternberg. How and how much can intelligence be increased. Norwood, NJ: Ablex Publishing Corp.

Sternberg, R. J. (1983). Criteria for intellectual skill training. Educational Researcher, pp. 6-26.

Sternberg, R.J. (1986). Intelligence applied. Toronto: Harcourt Brace Javanovich.

Sternberg, R. J. (1987). Teaching critical thinking: Eight easy ways to fail before you begin. Phi Delta Kappan, February, 460-466.

Sternberg, R. J., & Baron, J. B. (1987). Teaching thinking skills: Theory and practice. New York: W.H. Freeman.

Thorndike, E. (1913). The psychology of learning: Educational psychology. (Vol. 2). New York: Teachers College Press.

Torgesen, J. K. (1977). The role of nonspecific factors in the task performance of learning disabled children: A theoretical assessment. Journal of Learning Disabilities, 10, 27-34.

Torgesen, J. K. (1980). Conceptual and educational implications of the use of efficient task strategies by learning disabled children. Journal of Learning Disabilities, 51, 33-37.

Wasserman, S. (1987). Teaching for Thinking: Louise E. Raths revisited. Phi Delta Kappan. February, 456-459.

Weiner, J. (1986). Alternatives in the assessment of the learning disabled adolescent: A learning strategies approach. Learning Disabilities Focus, 1, 97-107.

Weinstein, C.E. (1982). A metacurriculum for remediating learning strategies deficits in academically underprepared students. In L. Noel & R. Levitz (Eds.). How to succeed with academically underprepared students. Iowa City: American College Testing Service Center for Advancing Educational Practice.

Weinstein, C. E., And Underwood, V. L. (1985). Learning strategies: The how of learning. In S. Chipman, J. Segal, & N. R. Glaser (Eds.). Thinking and learning skills: Current research and open questions (Vol. 1, pp. 241-258.). Hillsdale, NJ: Lawrence Erlbaum.

Whimbey, A. & Lochhead, J. Problem solving and comprehension: A short course in analytical reasoning (2nd ed.). Philadelphia: Franklin Institute Press.

Wittrock, M.C. (1974). Learning as a generative process. Educational Psychologist, 11, 87-95.

Wittrock, M.C. (1986). Student's thought processes. In M. C. Wittrock (Ed.), Handbook of research on teaching. New York: Macmillan.

Wittrock, M. C. (1987). Teaching and student thinking. Journal of Teacher Education, XXXVIII, (6), 30-33.

Woolsey, J., Pace, S., Reid, J., & Mulcahy, R. (1988). Instructional materials to accompany Feuerstein's Instrumental Enrichment. Edmonton, AB: SPELT International.

Wong, B.Y.L. (1982). Strategic behaviors in selecting retrieval cues in gifted, normal achieving and learning disabled children. Journal of Learning Disabilities, 15, 33-40.

Wong, B. Y. L. (1985) Metacognition and Learning Disabilities. In D. L. Forrest-Pressley, G. E. MacKinnon & Waller, T. G. (Eds.) Metacognition, cognition, and human performance. Toronto: Academic Press.

CHAPTER II SPELT (STRATEGIES PROGRAM FOR EFFECTIVE LEARNING/THINKING): A DESCRIPTION AND ANALYSIS OF INSTRUCTIONAL PROCEDURES

The type and sequence of instruction over time has a direct effect on the learner outcomes of pupils (Bower and Hilgard, 1981; Costa, 1985; Gagne´, 1985; Gagne´ & Briggs, 1979; Joyce & Weil, 1986; Marzano et al, 1988). It is therefore important to know both the methodology and the order of instruction that will facilitate specific outcomes. This applies to both the sequence of instruction used for individual lessons (the micro sequence), and the overall design of a course or curriculum (the macro sequence) (Van Patten, Chao, & Reigeluth, 1986), irrespective content type (declarative, procedural or conditional) (Jones, Palincscar, Ogle, & Carr, 1987). This viewpoint appears to be consistent with the SPELT (Strategies Program for Effective Learning/Thinking) Instructional Model . The SPELT model is a three phase continuum of instructional methodologies which attempts to systematize **the type and sequence of instruction to use** when teaching cognitive strategies in regular classrooms using customary content materials (Mulcahy, Marfo, Peat, & Andrews, 1987).

The teaching of cognitive strategies within content is based on the assumption that thinking is intimately connected with the domain specific knowledge in which it is used (Beyer, 1985). As Nickerson (in press) states, "to think effectively in any domain one must know something about the domain, and in general, the more one knows the better" (p.11).

Domain independent thinking processes (i.e self-regulatory skills) are also addressed by SPELT in the context of knowledge acquisition. This follows Glaser's (1984) recommendation that domain independent thinking processes be taught within the course of acquiring domain-related knowledge.

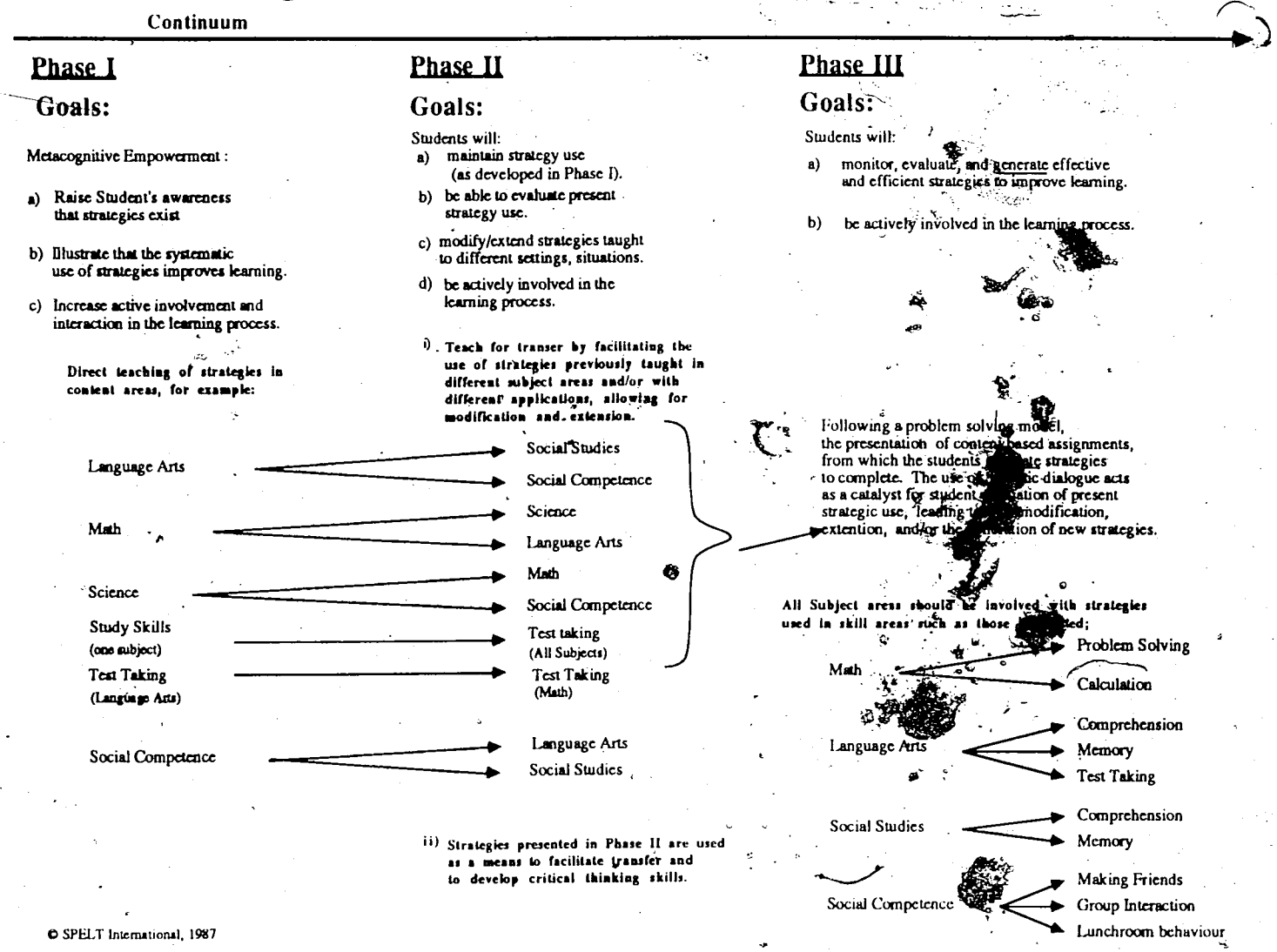
In the SPELT instructional context, cognitive strategies are conceptualized as "internally organized skills or control processes by which the learner regulates his/her cognitive behavior"(Gagne´, 1977 in Mulcahy, Marfo, Peat & Andrews, 1987, p. 8). A learner's repertoire

of strategies is analogous to a set of tools that enables him/her to more effectively and efficiently activate and regulate cognitive activities such as attention, concentration, comprehension, retention, and retrieval of information, as well as thinking and problem solving (Mulcahy, et al, 1986; Mulcahy, Marfo, Peat & Andrews, 1987). The source of the learning strategies and the teaching methodologies contained in the original research edition of the SPELT manual (Mulcahy, Marfo, & Peat, 1984) came from literature reviews of applied and theoretical cognitive psychology. Each of the individual strategies presented in the SPELT program had some degree of empirical validation with various populations (i.e. learning disabled, average ability, college level, etc.). By the second year of piloting the program, some had ecological validity due to their being designed by students in grades 4 - 7. By drawing on the instructional experience and insight of the [illegible]ors, as well as an analysis of the content of the literature review, the instructional model was formulated.

Is this instructional model defensible when analyzed in terms of current curriculum theory, a discipline which seeks to organize instructional materials in some orderly fashion for effective learning and teaching (Bower & Hilgard, 1981)? By applying instructional design principles to an analysis of the SPELT Instructional Model, it is hoped that new insights will be gained regarding its theoretical and empirical validity as well as its efficacy as a mode of instruction (Joyce, 1985).

Instructional design serves as a blueprint to help decide which methods of instruction should be used under given circumstances to bring about desired changes in students. The question of particular importance when proposing any instructional model is: How should instruction be sequenced over time? (e.g. What should be the order of presentation? When should practice take place?) (Johnson, 1981; Van Patten, Chao, & Reigeluth, 1986). Rephrasing this question to apply directly to the SPELT Instructional Model it becomes: "Is the SPELT Instructional Model well-founded when scrutinized in light of research and theory regarding the sequencing of instruction?" In order to explore this question, a brief description of the SPELT Instructional Model (see Figure 1) is presented.

Figure 1 - SPELT Instructional Model



Description of the SPELT Instructional Model

In describing the SPELT Instructional Model, first the general, then the specific goals will be outlined, followed by an explanation of the methodologies employed to achieve the stated goals.

General Goals

The SPELT Instructional Model is described by the authors as translating contemporary cognitive psychological theory and research into a practical and easy-to-implement instructional program (Mulcahy et al, 1986). It takes into consideration the concerns, guidelines and recommendations from numerous theorists and researchers whose work has been directed towards improving cognitive education programs (e.g., Bransford, Arbitman-Smith, Stein & Vye, 1985; Glaser, 1984; Nickerson, Perkins & Smith, 1985; Snow, 1982; Sternberg, 1983, 1985, 1986; Sternberg & Baron, 1987; Wittrock, 1986) (Mulcahy, Andrews & Peat, 1988). In broad terms, the goals of SPELT include training students:

a) to become active learners, thinkers, and problem solvers,

b) to become more planful and strategically efficient in their approach to learning,

c) to become independent learners, and,

d) to be aware of, and to control their own thinking processes (metacognitive empowerment) (Mulcahy, Marfo, Peat & Andrews, 1985, 1987).

Specific Goals of Each Phase

A progression from the lowest level of strategy acquisition (acquisition through teacher imposition-Phase I) to the highest level of acquisition (acquisition through self-generation-Phase III) is involved in the SPELT Instructional Model continuum. This approach has been recommended or alluded to by various authors (Derry and Murphy, 1986; Marzano et al, 1988;

Rigney, 1978). Phase I teaching consists of the presentation of a number of recommended and teacher generated strategies designed to expose the students to the fact that cognitive strategies exist (metacognitive awareness) and to illustrate that organized, goal-directed and efficient use of learning strategies increases their ability to acquire, think about, remember, retrieve, express and apply, information and ideas (Jones, Palincsar, Ogle, & Carr, 1987; Marzano et al., 1988; Pressley & Levin, 1983). As the students practice these strategies in the content areas, active involvement and interaction with the material to be learned is facilitated. This extended exposure to, and practice using these strategies begins the process of consciously building the students' personal repertoire of useful strategies to serve as tools for learning new material (metacognitive empowerment) (Ellis, Lenz, & Sabornie, 1987a; 1987b). Phase I instruction is viewed as the systematic establishment of student's strategic knowledge base which, in turn, [redacted] the groundwork for Phase II and III teaching. During Phase I, the source of control for strategy use is with the teacher. Remaining within this phase, however, leaves little room for students to participate in the determination of which strategies are appropriate for what purposes, or for including previously developed personal strategies (Costa, 1984; Derry & Murphy, 1986; Doctorow, Wittrock & Marks, 1978). This teacher imposed approach is **only the initial starting point** of SPELT instruction; in fact, staying within this phase runs counter to the previously stated goals, namely, to facilitate active participation of the students in the learning process and for students to become independent learners (Marzano et al , 1988; Mulcahy et al, 1986; Nickerson, Perkins & Smith, 1985).

Further support for this approach is derived from evidence showing that a pervasive characteristic of those with learning difficulties is their passive learning style which contributes to their reduced ability to generalize (Torgesen, 1977, Wong, 1982). If strategy instruction remains in Phase I, then a passive rather than active approach to learning is reinforced and modeled by the teacher who decides which strategies are important to share with the class. As well, particularly when students automatically employ established, habitual strategies, the imposition of a strategy may increase their metacognition, but may in fact, *be detrimental* to their performance and reduce the

expression of spontaneously generated learning strategies (Kanfer & Seidner, 1973; Mulcahy, Andrews, & Peat, 1988; Slee, 1983; Wagner & Sternberg, 1984).

However, the authors suggest that from the onset of Phase I, students be encouraged to express their impressions and experiences as they use strategies in order to begin the process of improving and/or modifying them to suit their own unique needs and abilities (Snow, 1982). This personalization of the strategies is said to become even more apparent in Phase II teaching. During Phase II, it is suggested that strategies initially taught in one subject area be systematically introduced in other subjects, settings and/or situations. This process of extending and adapting strategies to new applications is designed to facilitate the modification and/or extension of the strategies taught in phase I, since most strategies cannot be *exactly* duplicated as they are applied in varied settings, with different materials, and with differing assignment requirements (Glaser, 1984). An example is given whereby a comprehension monitoring strategy firstly taught in Language Arts could next be used in Social Studies, and afterwards be further modified to apply to the solving of a social interaction problem. The social interaction strategy, although still dealing with comprehension monitoring, would take a considerably different form than the original Language Arts comprehension monitoring strategy (one emphasizing the comprehension of written material and the other addressing the monitoring of verbal interactions) (Mulcahy, Andrews, & Peat, in press).

During Phase II, students are asked to identify other settings where strategies taught in Phase I could be applied, and also to analyze the efficiency and effectiveness of their own strategy use as they employ them in these new situations. During this instructional phase, students are taught specific generalization and critical thinking strategies to aid in this process (Mulcahy, Marfo, Peat & Andrews, 1987). The students' increased metacognitive awareness, thus acquired (Mulcahy, Andrews & Peat, in press), should facilitate generalization of a strategic knowledge base (Glaser, 1984). Note also that control of the student's learning is gradually shifted from the teacher to the pupils as the students acquire the skills of critically analyzing and discussing their own strategy use, and then using this information to modify and/or extend the strategies taught in Phase I

(Darko-Yeboah, 1988). Phase II, then, could be globally described as systematically teaching for transfer (Ellis, Lenz, & Sabornie, 1987a; 1987b).

By the time the students are functioning in Phase III, they are said to have acquired a large repertoire of learning strategies which have proven to be effective and useful. These strategies, supported by the metacognitive empowerment developed during the first two phases of instruction, are thought to serve as a knowledge base for the student **generation** of strategies during Phase III instruction. During this phase, content is presented to the students and tasks assigned, but with minimal teacher guidance as to how to complete the task. Discussion centers around an analysis of the task requirements and various learning approaches taken, or proposed by the students. The dialogue is directed toward the generation of a class-developed strategy or strategies. As in Phase II, these Phase III generated strategies are evaluated with the intent of further refinement and/or broader application. The active involvement of the pupils in the learning process is maintained as a goal throughout all three phases of SPELT instruction (See Mulcahy, Marfo, Peat & Andrews, 1987; Mulcahy, Andrews & Peat, in press).

Methodology

The instructional approach of SPELT recognizes that students require an initial foundational knowledge base consisting of insights, structure, and content in order for them to be able to actively construct new knowledge structures. This applies to all types of knowledge, whether it be declarative, procedural, or conditional (Jones, Palincsar, Ogle & Carr, 1988; Glaser, 1984). The methodologies contained in the SPELT instructional continuum emphasize the learning of procedural and conditional knowledge in the context of the regular classroom content (i.e. declarative, domain specific knowledge). Phase I teaching has as its goal the establishment of a strategic knowledge base to be further developed in the other two phases.

Figure 2: A summary of strategies in " A Strategies Program for Effective Learning / Thinking (SPELT)". (1987).

Phase I

Breaking a Normal Pattern: A habit or routine is interrupted as a reminder to perform a task or to remember information.

Concentration Strategy: A strategy for self-monitoring of inattentive behavior.

COPS: Self-correcting Strategy for editing written material.

DISSECT Word Identification Strategy: A systematic word attack strategy.

First-Letter Mnemonic Strategy: A five-step memory aid which particularly enhancing retention/retrieval.

Flow Charting: An organizational/planning device for breaking a process into sequential steps.

Four-Link System: A note-taking system that represent the interrelationships among concepts/events.

Keyword Visual Imagery Strategy: A strategy to enhance vocabulary development and/or spelling using visual imagery.

Loci Strategy: Using visual imagery to link items to be learned with familiar surroundings.

Math Word Problems: A seven point procedure for solving math problems.

Mr. Doll Strategy: A memory aid showing direction to move the decimal point when multiplying or dividing by 10s, 100s, 1000s, etc.

Multipass Textbook Attack Strategy: For quickly attacking textbook passage with comprehension.

My Vocabulary Builder: A guide for students to find the meaning of words and for the teacher to keep track of students' vocabulary development.

Note-Taking Strategy: Formats are presented on which to take notes while using the 5-R System.

ODD Strategy: A device to make children aware of their degree of emotional discomfort using the drawing of thermometer scaled 0-100.

Oral Report Presentation Strategy: Memory cues using first letter mnemonics to enhance students' oral presentation skills.

Outlining 1: A number of differing formats for report writing, note-taking, or essay writing, divided into content areas.

Pegword Strategy: Memory pegs are linked to numbers through the use of rhyme, which in turn is linked to material to be learned through visual imagery.

RAP: Paraphrasing Strategy: A reading comprehension monitoring strategy.

Relaxation Strategy: An eleven-point strategy to help students relax in stressful situations.

Request Strategy 1: A number of activities to facilitate students' question asking abilities.

A color-Keyed Mobile Strategy (Bloom's Taxonomy Mobile): An aid to facilitate students' awareness and usage of levels of questioning.

RIDER Visual Imagery Strategy: A visual imagery strategy for improving comprehension.

SCORER Test Taking Strategy: A six-step organizational strategy useful in test-taking situations.

Self-Questioning Strategy: Six steps to help reading and writing comprehension through self-questioning.

Spelling Strategy: A self-instructional spelling strategy.

SPOT Social Problem Solving Strategy: A strategy for systematically analyzing a social problem.

SQ3R Textbook Chapter Strategy: A review or study strategy helpful for comprehending large volumes of material.

STAR Creative Writing Strategy: A brain-storming technique for generating ideas for creative writing.

Story Map Reading Comprehension Strategy: A framework for organizing, monitoring, and analyzing the relationships obtained from reading material.

Strip Multiplication: An aid for completing multiplication questions until times-tables are memorized.

Telegraphic Messages Note-taking Strategy: A short-hand way of representing information useful in taking notes in class.

Phase II

Socratic Dialogue (Teaching Strategy): A way of creating and validating knowledge through probing, clarification, and/or systematic questioning with the teacher taking the role of mediator.

AVID: strategy for Transfer: A strategy to aid memory and transfer of strategies already taught.

Paired Problem Solving Strategy: A way of solving problems in which partners take turns in monitoring each other's thinking.

PMI: (Plus-Minus-Interesting) Strategy: In order to explore an issue, all the positive, negative and interesting points are listed.

Phase III

Memory Strategies: A teacher's guide in helping students to evaluate alternative ways of memorizing material.

Organizational Strategies: A guide for analyzing students' level of proficiency in terms of time and materials to be organized.

Outline 2: A review of previously learned outlines is used as a guide for students to generate more outlines for writing assignments.

Positive-Self-Talk: An aid for concentration and regulation of one's own behaviour.

Problem-Solving Strategies: Students are encouraged to use strategies for solving problems by clarifying, planning, monitoring, and evaluating the steps used.
Reading Comprehension Strategies: Encouraging students to use questioning and categorization techniques to organize the material they read.
Study Skills Strategies: A process of guiding students to use efficient study habits.
Vocabulary Building for Comparing and Contrasting: A guide for teaching words that helps students to compare and contrast.

(adapted from Darko-Yeboah, 1988)

The linear, step-by-step design of some of the strategies, with their built in mnemonic (see Figure 2), as well as the goals of Phase I (see Figure 1), appear to be consonant with direct teaching, or teacher imposition. The recommended methodology is teacher directed; a modification of the work of Deschler/Schumaker and their associates (Deschler, Warner, Schumaker, & Alley, 1984) at the Kansas University Institute for Research in Learning Disabilities (KU-IRLD). According to the authors (Mulcahy, Marfo, Peat, & Andrews. 1987), it has been adapted to suit the instructional environment and needs of youngsters in the regular classroom as compared to its original application with the learning disabled adolescent population (Lefrancois, 1988). Seven steps are involved in the instructional sequence:

1) Motivation and Measurement Base

2) Sell-Job

3) Modelling

4) Drill For Memorization

5) Practice

6) Feedback, and

7) Post-Test

These seven steps are designed to provide a structured approach that teachers can immediately apply to the classroom teaching of strategies **during Phase I** of the SPELT program. They are consistent with the teacher imposed model of instruction and are intended to allow the goals of Phase I to be quickly and efficiently reached. They take into account empirically proven motivational and instructional principles such as cognitive dissonance (Festinger, 1957), advanced organizers (Ausubel, 1964), relating to the experiences of the children (Jones, Palincsar, Ogle & Carr, 1987), modelling (Bandura, 1982), over-learning (Thorndike, 1913), etc. However, as soon

as the goals of Phase I are met, either for specific individual strategies and/or for strategy teaching in general, as has been previously stated, it is imperative to shift to Phase II.

Phase II teaching then, has as its major emphasis the systematic transfer of the strategic repertoire established in Phase I to other situations, settings, and applications (i.e. generalization).

For both Phases II and III, the recommended teaching methodology shifts from the direct teaching at Phase I to the use of **Socratic Dialogue** - an interactive relationship between teacher and students where the teacher leads the students through questioning to discover relationships for themselves. Socratic Dialogue is operationalized in the SPELT Manual based upon the work of Collins (1977). It employs guidelines such as: a) starting with what is known, b) asking for multiple reasons, c) asking for intermediate steps in the student's reasoning, d) forming general rules from specific cases, e) picking counter examples when insufficient reason is given, f) using extreme case examples to illustrate a mis-application of what was stated, g) probing for the differences between cases, and g) asking for a prediction. Key teacher behaviors which are embedded in Socratic Dialogue are also employed such as consciously using a 5-10 second wait-time, accepting and building upon student's responses, integrating student's responses to other information, extending student's ideas, clarifying student's responses, adding supplemental information, and not over-praising 'correct' answers (Brophy, 1986; French, 1984). Note that these teacher behaviors allow for, and indeed, encourage preciseness of vocabulary and clarity of expression. In fact, during discussion, if unclear communication is evident, the teacher's role is to facilitate clarity of responses before discussion continues. Socratic Dialogue is the chosen methodology for discussion revolving around the strategy use of students, but this type of dialogue can enhance the thinking skills of students during any classroom discussion regardless of content (Adler, 1982; Glaser, 1984; Mulcahy, Marfo, Peat & Andrews, 1987).

Phase III teaching continues to emphasize the use of Socratic Dialogue over and above the purpose of modifying and/or extending strategy use. It is also used as a means of guiding students to monitor, evaluate and **generate** effective strategies to aid **their own** acquisition, mediation and retrieval of the material to be learned. Unlike Phase I, learning in Phase III is largely student-

controlled rather than teacher-controlled (Rigney, 1978). A problem solving approach is also used (Bransford & Stein, 1983; Camp, & Bush, 1975;), so that when content based assignments are presented, students are assigned the responsibility of not only learning the material, but also to control how they will go about the learning process (Lefrancois, 1988; Mulcahy, Marfo, Peat & Andrews, 1987).

Sequencing of Instruction

The above has described the SPELT Instructional Model in some detail. We now return to the question: "Is the SPELT Instructional Model well-founded when scrutinized in light of research and theory regarding the sequencing of instruction?" Van Patten, Chao, & Reigeluth (1986), identify two fundamental types of **instructional** strategies which provide sequence and synthesis: "macro" and "micro". They view these two types of frameworks as a means to help instructional designers break subject matter into small pieces, order the pieces (sequencing), and then pull them together again based upon the interrelationships (synthesizing). In order to avoid confusion between **learning strategies** as defined previously, and **instructional strategies** which will be addressed in the following sections of this paper, the term **instructional procedures** will be used rather than **instructional strategies**.

Macro and micro procedures differ in two ways: a) the scope of content to which they apply and, b) the 'memory related outcomes' which they facilitate. Macro procedures are brought to bear on a broad scope of content and are utilized for organizing, integrating and coordinating a related set of skills and knowledge into lessons. Micro procedures, being narrower in content scope, are employed to organize the teaching of individual facts, concepts, principles, and/or techniques (Van Patten, Chao, & Reigeluth, 1986).

In terms of the differing 'memory outcomes' which the two instructional strategies advance, macro procedures deal with the overall organization of memory while micro procedures see to the acquisition of information (i.e. facts). The goal of macro procedures "is to create, or effect changes in, the structure of entire skill and knowledge repertoires" (Van Patten, Chao, &

Reigeluth, 1986, p. 438). The effects of macro procedures should endure over a long period of time, and should more strongly influence transfer and problem solving skills than micro procedures. An interaction is evident in that, the success of macro procedures is somewhat dependent on the effectiveness of the micro procedures in establishing a factual knowledge base (Bransford et al, 1986; Glaser, 1984; Van Patten, Chao, & Reigeluth, 1986).

SPELT Instructional Continuum: A "Macro" Instructional Procedure

In applying the above structure to the SPELT Instructional Model, it becomes evident that the Phases I, II, & III instructional continuum represents a "macro" framework. The diversity of learning strategies (see Figure 2) "taught or nurtured through SPELT include the following:

-general problem-solving strategies;

-social problem-solving strategies;

-math problem-solving strategies;

-reading strategies;

-knowledge-acquisition strategies;

-memory strategies;

-study skills and time-management strategies;

-test-taking strategies;

-support (mood-setting) strategies; and

-general metacognitive strategies"(Mulcahy & Marfo, 1987, pp. 170-171). The SPELT instructional continuum integrates and coordinates this broad array of learning strategies, providing a framework for organizing these strategies into lessons. These strategies represent a wide sampling from the literature (See also Dansereau, 1979; Brophy & Good, 1986; Nickerson, Perkins & Smith, 1985; Presseisen, 1987; Sternberg, 1986; Weinstein, 1982; Wittrock, 1986).

Van Patten, Chao and Reigeluth's (1986) macro distinction continues to hold when the overall goals are related to the type of memory outcomes desired. SPELT's overall goals of training students to become active learners, thinkers, and problem solvers; to become more planful and

strategically efficient in their approach to learning; to become independent learners; and to be aware of, and to control their own thinking processes (metacognitive empowerment), all relate to creating or effecting changes in the structure of an entire skill and knowledge repertoire, in this case, the area of "learning/thinking strategies".

As well, the SPELT instructional continuum closely aligns with the description of macro and micro procedures and their interactions described above. To illustrate, a broad goal of Phase I is to establish a strategic knowledge base. This knowledge base can be viewed as interacting with the overall macro procedures (i.e. the instructional continuum); if the knowledge base is not intact, students cannot function in either Phases II or III.

Phase II emphasizes generalization principles and is described as systematically teaching for transfer. Phase III is depicted as following a problem-solving approach (Mulcahy, Andrews, & Peat, 1988). As previously stated, the use of effective macro teaching procedures should strongly influence both transfer and problem solving skills. This adds further credence to the conceptualization of the overall SPELT instructional continuum being viewed as a macro instructional strategy.

Finally, the overall goals of the SPELT program refer to a permanent change in the student's approach to learning, which is consistent with the effects of macro teaching sequences enduring over a long period of time.

SPELT's Phases I, II, and III Methodologies: "Micro" Instructional Procedures

As previously described, each phase of the SPELT program contains methodologies designed to be consistent with the goals of a particular phase. These methodologies, from the seven teaching steps in Phase I to the 'Socratic Dialogue' of Phases II and III, can be viewed as micro teaching procedures based on the following analysis. They are narrower in scope than the macro procedure, and are employed to organize the teaching of individual facts, concepts, principles, and/or techniques in the area of learning strategies. For example, Phase I's goals of teaching students that strategies exist and that they work (Mulcahy & Peat, 1988), is much narrower in scope

than the broad goals of the instructional continuum . The methodologies also directly apply to designing of specific lesson plans, hence they can be viewed, following Van Patten, Chao, & Reigeluth's (1986) framework, as micro instructional procedures.

It was important to identify the difference between macro and micro instructional procedures, and how the SPELT instructional model relates to the descriptions of each, in order to analyze whether or not the SPELT program uses effective and efficient instructional procedures in its program design. Are empirically proven macro and/or micro instructional procedures embedded within the SPELT Instructional Model? Are they sequenced on the instructional continuum in a way that will facilitate the student learning outcomes as described in both the general and specific goals of the SPELT program?

Research from the past three decades addressing the issue of generalization through the systematic sequencing of material has direct relevance to classroom application. In their review of these empirical findings, Van Patten, Chao, & Reigeluth (1986) summarize early research ("scramble" studies) and current research relating to micro and macro instructional sequencing. This information is briefly summarized below and related to the SPELT Instructional Continuum.

Scramble Studies

Early research in the area of instructional design is labelled as "scramble" studies (Van Patten, Chao, & Reigeluth, 1986) due to its emphasis on investigating the effects of a "scrambled" (random) presentation of small blocks of content versus a "logical" sequence. Based upon Skinnerian principles, the studies stressed stimuli and response contiguity and contingency of reinforcement (S-R-S chaining).

No conclusive results were obtained from Van Patten,Chao & Reigeluth's (1986) review of these scramble studies due to four main factors. What was sequenced : 1) was not clearly identified, 2) lacked a clear differentiation between macro and micro levels of organization, 3) did not clearly differentiate the types of instructional outcomes, and finally, 4) did not follow precise organizational principles.

However, one series of studies (Buckland, 1968 in Van Patten, Chao & Reigeluth, 1987) did differentiate between macro and micro sequencing. A pattern of results emerged in these investigations, from which Van Patten, Chao, & Reigeluth (1987) infer that "micro sequence affects remember-level outcomes and, if the effects of micro and macro sequencing are additive, macro sequencing affects use-level outcomes (application)" (p.443).

Since the scramble studies had their basis in behavioral psychology, they were dealing with content in the traditional sense (i.e. declarative knowledge). SPELT gives predominance to the learning of procedural and conditional knowledge. However, these findings seem to have some relevance when analyzing the SPELT Instructional Model, particularly in Phase I where the SPELT goals accent declarative knowledge in the area of thinking strategies. Phases II and III of SPELT, underscoring procedural and conditional knowledge rather than a factual emphasis, do not cleanly fit this analysis. Perhaps Van Patten, Chao, & Reigeluth's inferences described above apply best to declarative knowledge rather than procedural and conditional knowledge.

To illustrate, Phase I of SPELT, as previously described, can be viewed as building a strategic repertoire (knowledge base) to be used in Phases II and III. Two factors here relate to the scramble study findings. Firstly, the micro sequence in Phase I is intended to strengthen the view: 1) that learning strategies exist, 2) that effective and efficient use of these strategies enhance learning and, 3) the remembrance of several specific, labelled strategies. This aspect of the SPELT's micro organization appears to harmonize with the inference re the remember-level outcome as mentioned above. Secondly, the movement from phases I to III along the SPELT instructional continuum was designed to have an additive effect (i.e. as experience with a wider array of strategies is achieved, the goals of each phase are consolidated) enhancing the student's ability to **apply** learning strategies to different situations and settings. This design is consistent with the inference of macro sequencing affecting application just described.

Micro Sequencing

The major elements of content for micro sequencing identified by Merrill, Reigiluth, and Faust (1979), in their Component Display Theory are as follows. They view the 'grist' of instruction as being composed of two elements; either **generalities** or **instances**. Generalities are seen as definitions or rules, and an instance defined as an example of the generality or rule.

Merrill, Reigiluth, & Faust (1979), suggest that these generalities and instances can be presented in two ways, namely, either expository (e.g. direct teaching-"Here is an example..."), or inquisitory (e.g. "Is this an example of...?"). This framework, gives four primary forms of presentation for micro sequencing of content as illustrated by the 2 X 2 matrix shown in Figure 3 below.

Figure 3

a) generality in expository form	b) generality in inquisitory form
c) instance in expository form	d) instance in inquisitory form

Micro sequences are composed by ordering the above four presentation forms. The expository versus inquisitory instructional sequences have been shown to have different instructional outcomes (Van Patten, Chao, & Reigeluth, 1986). An expository approach results in better near transfer (Evans, Homme, & Glaser, 1962), while an inquisitory approach results in better far-transfer (Guthrie, 1967, Roughead & Scandura, 1968, Scandura, Woodward & Lee, 1967).

If we view SPELT content as consisting of cognitive strategies, then the definition of strategies as "a set of tools that enables the learner to more effectively and efficiently acquire, retain, and apply new information"(Mulcahy, Marfo, Peat, & Andrews, 1987, p.8) is a generality, and a specific strategy such as the RAP Paraphrasing Strategy (p.145.) is an instance. The SPELT micro sequences (Phase I, II, & III methodologies) each have differing transfer goals. Phase I, an expository approach (i.e. direct teaching) aims to establish a strategic knowledge base. Phase I

attempts to systematically extend the knowledge base established in Phase I, a near transfer goal. According to the research cited above, the choice of an expository approach in Phase I as a way to facilitate near transfer, appears sound. The use of Socratic dialogue at Phases II and III, coupled with a problem-solving approach in Phase III, (both of which are inquisitory approaches) appears consistent with the Phase III far-transfer goals, namely, that the students will exhibit a planful, strategic approach to content in *all subject areas* (Mulcahy, Marfo, Peat, & Andrews, 1987).

Another line of research bearing on the theme of generalization, addresses the instructional components required to achieve concept attainment. Component Display Theory (Merrill, Reigiluth, & Faust, 1979), identifies three major events of instruction necessary when teaching content in order to achieve concept attainment ("use-a-generality"). They are: 1) the presentation of a definition or rule (generality), 2) the presentation of examples and sometimes non-examples, and 3) the availability of practice with feedback (Van Patten, Chao, & Reigeluth, 1986). Note that Phase I of the SPELT Instructional Model has each of these components embedded in the recommended 7-step methodology. Specifically, the individual strategies are directly taught and labelled (generality); as well, the teacher cognitively models the strategy (example). Then opportunity is given for the student to practice the strategy with feedback (example and /or non-example) using content material. Thus, according to Merrill, Reigiluth, & Faust's conceptualization, the SPELT Phase I teaching methodology contains the major components necessary to facilitate concept attainment. In this case the concepts are stated in SPELT's Phase I goals, scilicet, that the students are aware that learning strategies exist and that the use of these strategies enhances learning.

Other kinds of micro-level sequencing are also of concern to instructional designers such as the order of presentation of specific examples (i.e. level of divergence; range of difficulty). The micro-sequencing of the SPELT instructional model is supported by findings in these areas, as well. According to Merrill, Olson, & Coldeway, (1976, cited in Van Patten, Chao, & Reigeluth,1986), successive examples should be as divergent as possible, and should be sequenced in an easy-to-difficult order (Klausmeier & Feldman, 1975). Movement through the Phase I to III

continuum (the macro-sequencing) for each strategy and for strategy teaching in general, does encourage the successive divergence and complexity of strategy examples.

However, the methodologies of each phase of the SPELT program (i.e., the micro-sequencing) emphasize **how** to introduce, maintain, and develop strategy use in students, but do not specifically address the individual strategy sequence. This issue is discussed during inservice training and indirectly shown by sample lesson plans and cross-referencing of strategies throughout the SPELT Manual (Mulcahy, Marfo, Peat & Andrews, 1987). It is hoped that these areas will be more thoroughly addressed in a future edition of the document.

Macro Sequencing

Many of the prescriptions about sequencing of content are widely known, and have been determined through research and/or theorizing about the macro level of instruction. These include spiral curriculum (Bruner, 1960), progressive differentiation (Ausubel, 1963, 1964, 1968), and hierarchical sequencing (Gagne´, 1968, 1977, 1979). These are briefly described below. A less widely known approach called elaboration (Reigeluth & Stein, 1983) holds potential to provide guidelines for sequencing specific kinds of content. It will be included in the analysis of the SPELT's three phase macro sequence.

Spiral Curriculum

Bruner's *spiral* approach (1960), proposed that crucial ideas of a subject be taught at each grade with increasing complexity and sophistication, with the periodic recycling of these ideas functioning like a spiral. Crucial ideas are defined as those "great issues, principles, and values that a society deems worthy of the continual concern of its members" (p. 52.). He theorized that this approach should facilitate a deeper and more intuitive understanding of the subject. However, it has been difficult for curriculum designers to implement a spiral approach since Bruner has not provided enough specific guidance as to **how** to teach the concepts at the various stages of the spiral (Van Patten, Chao, & Reigeluth,1986).

The SPELT program has been implemented on a full scale in two complete school systems with every teacher from grades 4-12 being trained in the program. Part of the process of full scale integration involved strategy articulation across grade levels (Mulcahy, Darko-Yeboah, Peat, & Andrews, 1987; Mulcahy, Andrews & Peat, 1988). This articulation can be viewed as using a 'spiral' approach since the content, in this case the strategies, are 'recycled' at each grade but with increasing complexity due to their application with higher level content materials. As well, at each grade level a 'spiral' approach is evident in that, over time, the crucial concepts stated in the goals of each phase are reintroduced, but at increasing levels of sophistication and breadth of application as the students progress through Phases I to III.

Progressive Differentiation

The instructional theory based upon the concept of *progressive differentiation* as popularized by Ausubel (1960), assumes that learner's cognitive structures are organized hierarchically with highly inclusive concepts subsuming less inclusive subconcepts and informational detail. He believes people naturally organize learned detailed material under general types of information. He therefore recommends a "top-down" or general-to-specific sequence when presenting content to students. "Advance organizers" (i.e., general and inclusive ideas) are to be presented first, followed by related ideas of greater specificity and detail in order to provide "progressive differentiation" of the general, inclusive, "anchoring" ideas. Each level of specificity serves as an "advance organizer" for the next even more detailed and specific level. Many advance organizer studies using highly conceptual, verbal types of content have tested Ausubel's framework. Results indicate that such a sequence is beneficial when "unmastered prerequisite knowledge and abilities are important components of the content and when transfer is an especially important outcome"(Van Patten, Chao, & Reigeluth, 1986, p.447).

Does the SPELT instructional model use a "top-down" sequence at the macro level? Many of the strategies within SPELT can be viewed as being a highly verbal type of content, as can the teaching methodologies. For example, 1) all strategies are labeled, 2) verbal modelling by the

teacher is recommended, and 3) clarity of communication is insisted upon. An analysis of the model following Ausubel's framework then, appears to be in order.

When looking at the goals of SPELT's three phases, it becomes evident that there is progressive differentiation of the concept of 'strategies' as the students advance from one phase to the next. Phase I teaching aims to help the student's realize, through experience, simply that strategies exist and that when used, strategies work. This is considered an advance organizer; a general, anchoring idea. The next two phases of teaching build upon this information, and influence the students to perform detailed analysis of their strategic repertoire in order to judge the effectiveness and efficiency of their personal strategy use, and to modify, extend, or generate new strategies based upon their critical examination.

However, the instructional continuum as a macro organizational framework operates simultaneously with a particular micro sequence, depending upon what phase the students are operating in. In one classroom, the macro framework can be the overall organizational approach, with students operating in different phases at the same time, using the same content.

In SPELT, Ausubel's "top-down" approach is evident not only in the macro framework but also in the micro instructional sequences. For example, in the Phase I seven-step teaching methodology, and in the cognitive dissonance procedure used in the presentation of content in Phase II. Specifically, the 'motivation and measurement base' (step one, Phase I), allows students to see that those of their peers who are systematic and strategic in their approach to a task, are more successful - an "anchoring" idea. This is further emphasized in step two, the sell job, and also in step three, the teachers modelling. The specifics of the strategy are then addressed as the students learn the actual steps in performing the strategy. In Phase II the presentation of tasks that can only be completed if the students are strategic in their approach is parallel to the motivation and measurement step of Phase I just described.

Ausubel's "top-down" sequence, shown to be effective as a means to introduce new content and when transfer is an important outcome, appears to be utilized at various points in the SPELT instructional model, not just at the macro level. The "top-down" sequences described

appear to be consistent with the stated goals of SPELT, that is, the establishment of a strategic repertoire (new content), and the systematic teaching for transfer (Phases II and III).

Hierarchical Sequence

Hierarchical sequencing, or a "parts-to-whole", "bottom-up" approach (Gagne´, 1968), is also evident at different points in the SPELT instructional model. Hierarchical sequencing refers to the most elemental parts being taught first, therefore at the bottom of the hierarchy, followed by the teaching of increasingly complex combinations of the parts, which gradually build the hierarchical structure of the content. When using this sequence as a macro organizational structure, it has been found that the learning of higher order skills are facilitated (Van Patten, Chao, & Reigeluth,1986).

During Phase II, SPELT instruction emphasizes analysis and critical thinking, both higher order skills (Presseisen, 1987), as are the problem solving strategies accented during Phase III. According to hierarchical sequencing theory, the SPELT instructional continuum (the macro structure), if structured using a hierarchical sequence, should facilitate the learning of these higher order skills. If we view the teaching of strategies as the SPELT content, we can see that the increasingly complex and varied **application** of the strategies is organized in a 'bottom-up' hierarchical manner. As a starting point in Phase I, SPELT recommends the teaching of a learning strategy in one subject area with a gradual expansion of the use of the strategy into other content areas, and finally to all content areas (Mulcahy, Marfo, Peat & Andrews, 1987). This process allows the strategies to be initially presented in their most elemental form, followed by more complex combinations of strategies as the students progress along the continuum.

As can be seen from the above analyses, neither the 'progressive differentiation' nor the 'hierarchical sequencing' frameworks are able to explain fully or clearly the SPELT macro structure. The SPELT instructional model does not exclusively use either approach ; both a "top-down" and a "bottom-up" organizational structure is seen at different points along the instructional continuum. The "top-down" emphasis is used when the goal is the learning of prerequisite knowledge and the transfer of the acquired knowledge, with "bottom-up" sequencing followed when the goal is to

facilitate higher order thinking. "Elaboration Sequencing" reviewed in the following section, appears to offer a description more in harmony with the SPELT approach.

Elaboration Sequencing

Reigeluth & Stein's (1983) *Elaboration Theory* proposes an approach that employs variations of several organizing principles. It presents a sequence with two unique features: "a) the most general ideas *epitomize* rather than summarize the whole subject, and (b) there are actually three different sequences, each based on one *single* content orientation (i.e. content, procedure, or principle)" (Van Patten, Chao, & Reigeluth,1986, p.449.).

The general ideas 'epitomize' the subject since they represent a few of the most critical ideas and are delivered in a concrete, application based fashion. The ideas are fundamental, representative, and simple, thus requiring the learners to acquire these ideas at an application level (Van Patten, Chao, & Reigeluth,1986). Unlike previous sequencing procedures, "the elaboration approach is based on the notion that the nature of the simple-to complex sequence must differ depending on the **kind** [my emphasis] of content considered to be most important to the goals of instruction"(p.449). Different sequencing procedures are recommended for different content orientations. Specifically, if *concepts* are most important (addressing the *what*), then they should be organized into kind or part taxonomies, with the least complex taxonomy presented first, followed by increasingly complex ones. On the other hand, if *procedural content* is the emphasis (addressing the *how*), then the simplest possible version of the task is shown first followed by increasingly complex ones. Other types of content are "plugged into" the sequence at the most relevant points. Finally, if *theoretical* content is the most important (addressing the *why*), then the sequence is formed by first identifying the critical principles then prioritizing them by asking the question "What principles would you teach if you had the learners for only one hour" (Van Patten, Chao, & Reigeluth, 1986, p.450)?

The basic elaboration sequence used for any of the three content orientations is an interactive integration of Ausubel's "top-down" approach, Gagne's "bottom-up" sequence, and

Bruner's spiral curriculum. Van Patten, Chao, & Reigeluth (1986), describe the order of presentation as analogous to a camera's zoom lens. The epitome presents the most inclusive "wide-angle" picture, then in subsequent lessons the major ideas set forth are much like close-up "zoom-in" shots. Periodically during the process, instruction "zooms-out" acting as both a review of the wide-angle picture, and a preview of the next target for "zooming-in".

Elaboration theory then, appears to be helpful in providing detailed, specific guidelines for sequencing different types of content. Since many of the prescriptions provided, however, are yet to be empirically tested, the application of elaboration theory to an analysis of the SPELT instruction model is limited to description, and cannot be used for evaluative purposes.

Following elaboration theory, during strategy instruction using the SPELT model, learning strategies are presented (Phase I), evaluated, modified and/or extended (Phase II), or generated (Phase III), in a fashion such that each learning strategy could be viewed as acting as an 'epitome'; each is presented in a concrete, application based fashion and is representative of a member of the larger 'set' of learning strategies. As described previously when analyzing the SPELT instructional model according to Bruner's, Ausubel's , & Gagne's formulations, SPELT integrates principles contained in the spiral curriculum, "top-down" presentations and "bottom-up" approaches. The SPELT approach appears to parallel elaboration theory. It presents similar content at differing student levels and can be thought of as "zooming-in" and "zooming-out" of the strategy content according to the emphasis of instruction.

Is the detail provided in elaboration theory dealing with procedural content congruent with the SPELT model? SPELT has as its broad goal the establishment and/or development of student's effective and efficient strategic repertoires, which is procedural (addressing the *how*). However, its content can also be viewed as theoretical (addressing the *why*) since conscious metacognitive empowerment requires that the students not only know procedures (i.e. learning strategies), but also that they be cognizant of the reasons why they should approach tasks in a systematic and strategic fashion.

The SPELT instructional continuum appears to follow the recommendation of elaboration theory for sequencing procedural content. For each strategy the simplest version is shown first (i.e. in one content area), followed by increasingly complex applications, modifications, and extensions as the learning strategies are applied in various situations and settings. Note that the other type of content (i.e. the regular curricula concepts), are "plugged into" the sequence at relevant points determined by the teacher. In SPELT teaching, an interaction between the procedural and conceptual contents is evident. The regular curriculum may determine what learning strategies are presented, and to what subject systematic transfer is attempted.

In terms of theoretical content, the goals of the SPELT instructional model identify critical elements of strategy instruction. These critical elements are embedded within the overall instructional model which also guides the sequence of their presentation. The basis of the identification and sequence of these critical components was through the application of principles from applied and theoretical cognitive psychology, not the more subjective procedure suggested by elaboration theory.

Summary

The SPELT instructional model was described, then analyzed in terms of current instructional design principles. The goal of the analysis was to evaluate whether or not effective and efficient instructional procedures were used in the program design to achieve the stated desired learner outcomes. The major components of the SPELT instructional model were first categorized as broadly falling into either macro or micro instructional sequences. The overall instructional continuum was determined to be a macro structure, with the teaching methodologies of the three phases identified as micro sequences. It was found that parts of the SPELT instructional model, with its three methodologies, were consistent with theory and/or empirical findings of early scramble studies, Bruner's spiral curriculum, Ausubel's progressive differentiation, and Gagne's hierarchical sequence. Although not yet empirically validated, Reigiluth & Stein's Elaboration Theory offered the best overall descriptive analysis of the SPELT instructional model.

1. A version of this chapter has been submitted for publication. Peat, D., Mulcahy, R., & Darko-Yeboah, J. Instructional Science.

REFERENCES

Adler, M. J. (1982). The Paideia proposal: An educational manifesto. New York: Macmillan.

Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educational Psychology, 51. 267-272.

Ausubel, D. P. (1963). The psychology of meaningful verbal learning. New York: Grune and Stratton.

Ausubel, D. P. (1964). Some psychological aspects of the structure of knowledge. In S. Elam (Ed.), The structure of knowledge . Chicago: Rand McNally.

Ausubel, D. P. (1968). Educational psychology: A cognitive view. New York: Holt, Rinehart, and Winston.

Beyer, B. (1985). Practical strategies for the direct teachin gof thinking skills. In A Costa (Ed.), Developing Minds : A resource book for teaching thinking.. Alexandria, VA: ASCD.

Bower, G. H., & Hilgard, E.R. (1981). Theories of learning (5th ed.).Englewood Cliffs, NJ: Prentice-Hall.

Bransford, J. & Stein, D. (1983). The ideal problem solver. Van Nays, CA: W. H. Freeman.

Bransford, J., Arbitman-Smith, Stein, B. S., & Vye, N. J. (1985). Improving thinking and learning skills: An analysis of three approaches. In J.W. Segal, S.F. Chipman, & R. Glaser (Eds.), Thinking and learning skills: Relating instruction to basic research: Vol. 1 (pp. 133-206). Hillsdale, NJ: Lawrence Erlbaum.

Bransford, J., Sherwood, R., Vye, N., & Rieser, J. (1986). Teaching thinking and problem [illegible] American Psychologist, 41 (10), 1078-1089.B

Brophy, J.E. & Good, T.L. (1986) Teaching behavior and student achievement. In M. C. Wittrock (Ed.). Handbook of research on teaching (3rd ed.). New York: Macmillan.

Bruner, J. S. (1960) The process of education. New York: Random House.

Camp, B. & Bush, M. (1975). Think aloud program: Group manual-revised. Denver, CO: University of Colorado Medical School. ERIC Document Reproduction Service No. ED 142 024.

Chi, M.T.H. (1985). Changing conception of sources of memory development. Human Development, 28, 50-56.

Collins, A.(1977). Processes in acquiring knowledge in R.C. Anderson, R.J. Spiro and W.E. Montague (Eds.) Schooling and the acquisition of knowledge. Hillsdale, N.J: Lawrence Erlbaum.

Costa; A. (1984, November). Mediating the metacognitive. Educational Leadership, pp.57-62.

Costa, A. (1985). Teacher behaviors that enable student thinking. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking (pp. 125-139). Alexandria, VA: ASCD.

Dansereau, D.F., McDonald, B.A., Collins, K.W., Garland, J., Holley, C.D., Diekhoff, G.M., & Evans, S.H. (1979). Evaluation of a learning strategy system. In H.F. O'Neil, Jr. & C.D. Spielberger. Cognitive and affective learning strategies. New York: Academic Press.

Darko-Yeboah, J. (1988). An evaluation of two learning/thinking strategy programs. Unpublished Doctoral Dissertation, University of Alberta.

Derry, S. J. & Murphy, D. A. (1986). Designing systems that train learning ability: From theory to practice. Review of Educational Research, 56. 1-39.

Deschler, D. D., Warner, M. M., Schumaker, J. B., & Alley, J. R. (1984). Learning strategies intervention model: Key components and current status. In J. P. McKinney & L. Feagans (Eds.), Current topics in learning disabilities. Norwood, NJ: Ablex Publishing Corp.

Doctorow, M., Wittrock, M.C., & Marks, C. (1978). Generative Processes in Reading Comprehension. Journal of Educational Psychology, 70 (2), 109-118.

Ellis, E. S., Lenz, B. K., & Sabornie, E. J. (1987). Generalization and Adaptation of learning strategies to natural environments: Part 1: Critical agents. RASE, 8,(1) 6-20.

Ellis, E. S., Lenz, B. K., & Sabornie, E. J. (1987). Generalization and Adaptation of learning strategies to natural environments: Part 2: Research into practice. RASE, 8,(2) 6-23.

Evans, J. L., Homme, L. E. & Glaser, R. (1962). The RULEG system for the construction of programmed verbal learning sequences. Journal of Educational Research, 55, 513-518.

French, F. (1983). Learner strategies enabling thinking (LSET) : A guide. (A copyrighted manuscript)

Gagne´, R. M. (1968). Learning Hierarchies. Educational Psychologist. 6, 3-6.

Gagne´, R. M. (1977). The conditions of learning (3rd. ed.). New York: Holt, Rinehart, and Winston.

Gagne´, R. M. & Briggs, L. J.(1979). Principles of Instructional Design (2nd. ed.). New York: Holt,

Gagne´, R. M. (1985). The conditions of learning and theory of instruction. New York: Holt, Rinehart and Winston.

Glaser, R. (1984). Education and thinking: The role of knowledge. American Psychologist, 39, 93-104.

Guthrie, J. T. (1967). Expository instruction versus a discovery method. Journal of Educational Psychology, 58, 45-49.

Johnson, Jr., M. (1981). Definitions and Models in curriculum theory. In H. A. Giroux, A. N.Peanna & W. F. Pinar (Eds.) Curriculum and instruction, Berkeley, CA: McCutchan Pub. Corp.

Jones, B.F., Palincsar, A. S., Ogle, D. S., & Carr, E. G., (1987). Strategic teaching and learning: Cognitive instruction in the content areas. Alexandria, VA: Association for Supervision and Curriculum Development.

Joyce, B. & Weil, M. (1986). Models of teaching.(3rd. ed.) Englewood Cliffs, NJ: Prentice-Hall, Inc.

Kanfer, F. H. & Seidner, M. L. (1973). Self-control: Factors in enhancing tolerance of noxious stimuli. Journal of Personality and Social Psychology, 25, 381-389.

Klausmeier, H. J., & Feldman, K. V. (1975). Effects of definition and a varying number of examples and nonexamples on concept attainment. Journal of Educational Psychology, 67, 174-178.

Lefrancois, G. R. (1988). Psychology for teaching (6th.ed.). Belmont, CA: Wadsworth Publishing Company.

Marzano, R. J., Brandt, R. S., Hughes, C. S., Jones, B. F., Presseisen, B. Z., Rankin, S. C., & Suhor, C. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, VA: Association for Supervision and Curriculum Development.

Merrill, M., D., Reigeluth, C. M., & Faust, G. W. (1979). The instructional quality profile: A curriculum evaluation and design tool. In H. F. O'Neill, Jr. (ed.) Procedures for instructional systems development. New York: Academic Press.

Mulcahy, R. H., Marfo, K., Peat, D. W. (1984). SPELT: A Strategies program for effective learning and thinking-Research edition. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

Mulcahy, R. H., Marfo, K., Peat, D. W., & Andrews, J. (1985). Unpublished Inservice Training Materials. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

Mulcahy, R. H., Marfo, K., Peat, D. W., Andrews, J., & Clifford, L. (1986). Applying cognitive psychology in the classroom: A learning/thinking strategies instructional program. Alberta Psychology, 15, (3), 9-12.

Mulcahy, R. H., Marfo, K., Peat, D. W., & Andrews, J. (1987). SPELT: A Strategies program for effective learning/thinking-Inservice Edition. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

Mulcahy, R., Darko-Yeboah, J., Peat, D.,& Andrews, J. (October, 1987). Barrhead report on the SPELT program. 36 pages. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

Mulcahy, R. H., Marfo, K. (1987). Assessment of cognitive ability and instructional programming with native Canadian children: A cognitive processes perspective. In L. L. Stewin & J. H. McCann (Eds.), Contemporary Educational Issues The Canadian Mosaic (pp. 157-177). Toronto, Ont: Copp Clark Pitman.

Mulcahy, R. F., Darko-Yeboah, J., Andrews, J., Peat, D., Marfo, K., Clifford, L., Cho, S., & Norman, C. (1988). Cognitive Education Project, Executive Summary: Year 3. Cognitive Education Project, Department of Educational Psychology, University of Alberta.

Mulcahy, R. F., & Peat, D. (1988). Instructional video tape, Learning/thinking strategies instruction-SPELT (Strategies program for effective learning/thinking. (Available from the Instructional Technology Centre, University of Alberta.)

Mulcahy, R. F., Andrews, J., & Peat, D. (in press). Cognitive education: A longitudinal evaluation. In C. K. Leong & B. S. Randhawa (Eds.). Literacy and Cognition: Theory, Research and Instructional Implications. New York: Plenum.

Nickerson (in press). On improving thinking through instruction. Prepared for Review of research in education.

Nickerson, R. S., Perkins, D. N., & Smith, E. E. (1985). The teaching of thinking. Hillsdale, NJ: Erlbaum.

Presseisen, B. Z., (1987). Thinking skills throughout the curriculum: a conceptual design. Bloomington, IN: Phi Lambda Theta.

Presseisen, B. Z., (March,1988). Introducing thinking into the curriculum. Phi Delta Kappa Educational Foundation workshop materials. Philadelphia, PA: Research for Better Schools, Inc.

Pressley, M., Levin, J.R. (Eds.) (1983). Cognitive strategy research. New York: Springer-Verlag.

Reigeluth, C. M. & Stein, F.S. (1983). The elaboration theory of instruction. In C. M. Reigeluth (Ed.), Instructional theories and models: An overview of their current status. Hillsdale NJ: Lawrence Erlbaum.

Rigney, J.W. (1978). Learning strategies: A theoretical perspective. In H. F. O'Neil, Jr. (Ed.), Learning Strategies. New York: Academic Press.

Roughead, W. G., & Scandura, J. M. (1968). What is learned in mathematical discovery? Journal of Educational Psychology, 53, 101-104.

Scandura, J. M., Woodward, E., & Lee, F. (1967). Rule generality and consistency in mathematics learning. American Educational Research Journal, 4, 303-319.

Slee, J. A. (1983). The use of visual imagery in visual memory tasks: A cautionary note. In M. L. Fleming & D. W. Hutton (Eds.), Mental imagery and learning. Englewood Cliffs, NJ: Educational Technology Publications.

Snow, R. E. (1982). The training of intellectual aptitude. In D. K. Detterman & R. J. Sternberg. How and how much can intelligence be increased. Norwood, NJ: Ablex Publishing Corp.

Sternberg, R. J. (1983). Criteria for intellectual skill training. Educational Researcher, pp. 6-26.

Sternberg, R.J. (1985). Instrumental and componential approaches to the nature and training of intelligence. In S. Chipman, J. Segal, & N.R. Glaser (Eds.). Thinking and learning skills: Current research and open questions (Vol. 2, pp. 216-243). Hillsdale, NJ: Lawrence Erlbaum.

Sternberg, R.J. (1986). Intelligence applied. Toronto: Harcourt Brace Javanovich.

Sternberg, R. J., & Baron, J. B. (1987). Teaching thinking skills: Theory and practice. New York: W.H. Freeman.

Thorndike, E. (1913). The psychology of learning: Educational psychology. (Vol. 2). New York: Teachers College Press.

Torgesen, J.K., (1977). The role of nonspecific factors in the task performance of learning disabled children: A theoretical assessment. Journal of Learning Disabilities, 10, 27-34.

Van Patten, J., Chao, C., & Reigeluth, C. M. (1986). A review of strategies for sequencing and synthesizing instruction. Review of Educational Research, 56, 437-471.

Wagner, R. K. & Sternberg, R. J. (1984). Alternative conceptions of intelligence and their implications for education. Review of Educational Research, 54, 179-223.

Weinstein, C.E. (1982). A metacurriculum for remediating learning strategies deficits in academically underprepared students. In L. Noel & R. Levitz (Eds.). How to succeed with academically underprepared students. Iowa City: American College Testing Service Center for Advancing Educational Practice.

Wittrock, M.C. (1986). Student's thought processes. In M. C. Wittrock (Ed.), Handbook of research on teaching. New York: Macmillan.

Wong, B.Y.L., (1982). Strategic behaviors in selecting retrieval cues in gifted, normal achieving and learning disabled children. Journal of Learning Disabilities, 15, 33-40.

CHAPTER III-TEACHER INSERVICE TRAINING IN COGNITIVE EDUCATION

"We are dreaming about creating a school where the study of human thought is a central mission, where the cultivation of the intellect is comfortably woven with the study of values, the mastery of information, and training in the basic subjects" (Joyce & Weil, 1986).

Although teaching for thinking has become a national *cause celebre*, few Canadian school jurisdictions have been willing to commit the time, energy, expertise, and money necessary to translate teaching-for-thinking ideas into actual classroom practice. Perhaps this is partly due to the fact that teacher re-training is a challenging and complex task (Wasserman, 1987b).

Many of the commercially available, packaged cognitive education programs do require intensive inservice training (Black, 1986; Chance, 1986; Costa, 1985a; Nickerson, Perkins & Smith, 1985). However, the question of what intensity level or method of instruction is needed to prepare competent teachers of learning/thinking has not received adequate emphasis or attention (Nickerson, 1988).

In examining teacher inservice training in the area of cognitive education, at least two assumptions are made; first that changing teachers' instructional behavior affects student thinking, and second, that there is a need for change in the present state of affairs. A brief examination of these basic suppositions is in order.

Teachers' Influence on Students' Thought Processes

Teaching does influence students' thought processes. Students' thinking, in turn, mediates achievement and learning (Brophy, 1986; Joyce & Weil, 1986; Peterson, 1988; Wittrock, 1986). "What the students do with the information presented by the teacher-what sense they make out of it, how they relate it to what they know and believe-influences achievement" (Wittrock, 1987, p.30). The teaching-students' thinking, and the students' thinking-performance links have direct implications for the teaching of thinking. Information gleaned from studies emphasizing teachers' verbal behavior will serve as an example.

The type of questions teachers use have been demonstrated to have a direct influence on student achievement. However, these effects may be differential for divergent sub-groups of students (Bachor, 1985) and in differing contexts (Brophy, 1986). For example, rephrasing questions and giving longer time to answer, are factors which facilitate maximum performance for students with 'low-ability'. In contrast, the gifted perform better if the questioning proceeds at a quick pace, and when inferior work is periodically criticized. Taking a cognitive perspective helps to interpret the reasons as to why different teacher behaviors have these differential effects; how students' thought processes effect their performance. The cognitive interpretation is as follows. Questioning techniques give information to the students as to the teacher's expectations. For the 'low ability' students the teachers' rephrasing of responses and use of a long wait-time tells them that they are expected to think and that they will be provided with the time to think through a response. In short, thinking is required and important. For the gifted, the students' perceive the quickly paced questioning and periodic criticism as a challenge; they are to think quickly, but at a sophisticated level (Bachor, 1985).

Further evidence for teachers' instructional behavior effecting student performance is found in the positive relationship between the level of teachers' verbal behavior and the level of thinking of students (Costa, 1985c; Falkof & Moss, 1984). Costa uses this correlation to design a framework matching levels of questions/statements and desired cognitive behaviors. Teacher's questioning behavior, thus directed, becomes a tool for enhancing students' abilities to accept information, process or compare that information with what they already know; to draw meaningful relationships, and to apply or transfer these relationships to hypothetical or novel situations.

Teaching practice then, influences student thinking which, in turn, effects students' performance. Knowing this, many teachers value the teaching of thinking as an educational goal and use methods that facilitate its development.

The Need for Change

Most teachers however, do not employ techniques and approaches which foster the development of thinking in their students (Joyce & Weil, 1986; McTighe & Schollenberger, 1985). Teacher training of the past, largely based upon the behavioral school of psychology, ill-prepared teachers to explicitly teach cognitive skills to their pupils. Without a sound foundation in the nature of critical, creative, and reflective thinking, which comes from a cognitive orientation, teachers are unable to consciously stimulate or to recognize the products of such thinking in their pupils (Barell, 1985), and as well, fail to apply systematic thinking to their own daily instructional tasks (Martin, 1984).

Although behaviorism has made important contributions to educational methodology, particularly for those with special needs, it tends to emphasize control of learning by the instructor, thus devaluing pupil initiations and independence. The transfer of skills taught using a programmed approach remains a perennial problem (Ballard, 1987). Current cognitive theories of learning stress the importance of the interactive, experiential and constructive nature of learning and call for the cultivation of openness, freedom to think one's own thoughts and a respect for ambiguity. The cognitive orientation is therefore diametrically opposed to a behavioral one. This presents difficulties especially for teachers trained in a behavioral approach and/or with a need for controlling pupils, curriculum, timetables, etc. (Jones, Palincsar, Ogle, & Carr, 1987; Wasserman, 1987b). Even with the best of instruction, spontaneous transfer of cognitive skills is not nearly as frequent as one would anticipate (McKeachie, 1987). Is there any wonder that an equally bleak picture is painted when students cognitive performance is analyzed?

There is, unfortunately, overwhelming evidence which indicates that students do not think as effectively as they might (Marzano et al, 1988; Nickerson, in press). Norris (1985), using data from both traditional critical thinking multiple-choice measures and a think-aloud procedure, presents a review of systematic research in the area of critical thinking. He concludes that the student level of critical thinking is not extremely high at any level of schooling, including university

students enrolled in MBA and medical programs. A second example, comes from the American *National Commission on Excellence in Education* (Goldberg & Harvey, 1983). It reports that many 17-year-olds do not possess the higher order intellectual skills expected of them; nearly 40 percent cannot draw inferences from written materials, only one-fifth can write a persuasive essay, and only one-third can solve a mathematics problem requiring several steps.

Students' learning that takes place simply due to their being a part of the classroom organization and school system, is referred to as the hidden or implicit curriculum. Unfortunately, implicit learning often mitigates against the efforts by individual teachers to challenge pupils to think in complex ways. To illustrate, students learn that teachers have the right answers which they are required to figure out; that their answers should be short and as close to the teacher's perception of the right answer as possible ; that teachers decide what to do, and when, how and what to think of it afterwards, and; that learning takes place by listening to the teacher and reading textbooks, not through interactions with their peers (Barell, 1985). Children become "lesson-learners" - able to learn lessons factually, but unable to process facts intelligently to apply them to new situations (Wasserman, 1984).

To present a more positive picture, there is much empirical data supporting cognitive interventions with differing populations (see Deschler, Warner, Schumaker & Alley, 1983; Hallahan, et al, 1983 [LD]; Scott, 1988 [Gifted]; Dansereau, 1985; Weinstein, 1982 [College students]; Brown & Campione, 1977 ; Mulcahy, R. 1980 [MR]) and within a wide assortment of subject areas (see Jones, Palincsar, Ogle, & Carr, 1987; Nickerson, in press; Schoenfeld, 1985; Wittrock, 1986). Cognitive instruction is defined as "any effort on the part of the teacher or the instructional materials to help students process information in meaningful ways and become "independent learners" (Jones, 1986, p.7).

Research at the University of Alberta over the past few years has also supported the need for, and the utility of a strategy approach in educational intervention (for example, Andrews, 1984; Lupart & Mulcahy, 1983). "Cognitive instruction has the potential to alter substantially the capability of the learner, especially the low-achieving learner, in much the same way that microchips

radically altered the capability of the computer.....Explicit learning strategy training facilitates learning for low-achieving students, and there are strong data to suggest that cognitive instruction decreases the differences between younger and older students" (Jones, 1986, p.8, 9).

Having established a case for change in our present instructional practices, we turn to the issue of how best to facilitate this change on a system wide scale. When an instructional approach is adopted by a school or jurisdiction, it does not necessarily mean that it will be implemented as planned. For change to be permanent it must move through the stages of adoption to implementation to institutionalization. Change in this context, then, refers to instructional practices which become permanent features of the system (Joyce & Showers, 1980; Waugh & Punch, 1987).

Inservice workshops are generally inadequate in providing the training necessary as well as the support needed for truly advancing educational change (O'Haire & Thomas, 1988; Wasserman, 1984). Meaningful change takes place as a process, not as a single event. This process of educational change is complex, influenced by many factors, and takes place over a long period of time, probably at least two years (Barell, 1985; Wasserman, 1987b; Waugh & Punch, 1987). A helpful framework for examining this process, divides it into three sequential time components: **before, during,** and **after inservice** training.

Before Inservice

Teachers' fears, uncertainties, attitudes, cost appraisals, perceptions of the practicalities, and views of support mechanisms, greatly effect their receptivity to change. The school environment as well as the larger community environments encroaching upon the school, also are factors influencing change (Wasserman, 1987a; Waugh & Punch, 1987). Using what we know about this change process can help in the design of effective inservice training programs.

Change can be conceptualized by the formula: **ch = a • b • c > x** (Gleichy, in Garmston, 1985). Change in this view, equals the product of **a**, a shared dissatisfaction, times **b**, a shared vision of an ideal state, times **c**, knowledge about practical steps to move towards the vision, as long as the product is greater than the cost of change **x**.

The change formula described above, when applied to education at the local or district level, provides a tool for change agents to use when conceptualizing and analyzing change; when engaged in information gathering; and when designing custom tailored inservice training. For example, depending on the analysis of the local situation, there will be an identified need to either **create** a potent shared dissatisfaction or to **facilitate** a powerful common vision of the ideal. This would then be followed by a process to ensure that teachers acquire the needed background knowledge and practical techniques to move toward the ideal. If the cost of the change, both in time, training requirements, and materials is very expensive (i.e. *Feuerstein's Instrumental Enrichment*; Feuerstein, 1980), then shared dissatisfaction will need to be very widespread and a strong common vision established, in order to provide an optimum environment for implementation (Aquila & Galovic, 1988; Garmston, 1985).

Before formal inservice training in a specific cognitive education program or approach is undertaken, activities should concentrate on the establishment of the best personal and corporate environment possible for change. The activities should be spearheaded by a change agent who is:

1) objective,

2) aware of local conditions,

3) a representative a higher level of authority than the teachers, and

4) enthusiastic (Waugh & Punch, 1987).

Practical before training suggestions include:

1) Building a shared dissatisfaction by simply describing the existing circumstances. The information briefly reviewed in the introduction provides some general ammunition for this task. However the use of local assessment results, if available, in the areas of achievement, problem solving, and process measures could also be used. This description could be supplemented by teachers' elaborations of their own classroom examples of students lack of effective thinking (Garmston, 1985).

2) Video tapes in the area of cognitive education (i.e. *Tactics Preview Tape*, ASCD; *Learning Thinking Strategies Instruction-Instrumental Enrichment*, Instructional Technology Centre,