

# The 4MAT<sup>®</sup> Research Guide

**Reviews of Literature on Individual Differences  
and Hemispheric Specialization  
and their Influence on Learning**

**Bernice McCarthy, Ph.D.**

**Clif St. Germain, Ph.D.**

**Linda Lippitt, Ph. D.**

**About  
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# Mission & Theoretical Assumptions

The mission of the Department of Research at About Learning, Inc. is to validate the 4MAT System for Teaching, Learning and Leadership. In this light, the elucidation and verification of the theoretical assumptions of 4MAT as a model for maximizing human potential becomes a major goal of the About Learning, Inc. research effort. These theoretical assumptions, generally stated, include the following:

## Theoretical Assumptions

### Learning Types

- Individuals learn in different yet identifiable ways.
- These individual learning preferences, although clearly not related to aptitude, are significantly related to personal motivation and performance.
- Motivation and academic performance improve as individuals identify and use their natural learning style as well as practice and accommodate less preferred strategies.

### Hemisphericity

- Individuals have at their disposal two complementary methods for approaching and representing information and experience.
- Adequate engagement of both methods, described in the literature as Right and Left Hemispheric processing, results in deepened levels of personal understanding.
- Engagement of both hemispheres of the brain, usually defined as “Whole brain” learning has serious implications for designing instruction and understanding human learning.

### Teaching

- A demonstratable relationship exists between specific teacher behaviors and student performance.
- Learning and transfer are more appropriately encouraged when classroom events systematically incorporate attention to personal experience, reflection, conceptualization, practice, extension, refinement and integration using Right and Left Hemispheric representations.
- Multiple methods of instruction connected to personal meaning, including striving and self discovery, are related to higher levels of student performance.
- 4MAT is a practical pedagogy for teaching to “wholeness,” encouraging creativity and accounting for human diversity.

### Goals

The goals of the Department of Research include the following:

- To review and summarize all literature including dissertations, articles and research in the field, that include the 4MAT descriptor.
- To review and summarize prominent books and other studies related to the constructs which form the theoretical grounding for the 4MAT System.
- To conduct “Action Research” in the field aimed at illuminating and further validating the 4MAT System.
- To encourage and assist with dissertation research investigating the effects of 4MAT.

# Mission & Theoretical Assumptions

## Research Update

The information in this Research Guide is updated regularly. Please check the About Learning, Inc. website [www.aboutlearning.com](http://www.aboutlearning.com) for recent additions and articles. For a complete discussion of the 4MAT Model and the Natural Cycle of Teaching and Learning, please review Dr. McCarthy's texts, *About Learning*, (1996) and *About Teaching: 4MAT in the Classroom*, (2000).

The *4MAT Research Process Guide* is also available for use in planning research and evaluation. It presents an introduction to the research process with a focus on the evaluation of 4MAT implementation projects and the use of the 4MAT Model and instruments as variables in research designs. The Process Guide contains a collection of 20+ assessments and surveys for addressing the impact of the 4MAT Model on teachers, students and parents. You will find an overview of this material in Section 8.

## Instrument Research

All instruments used in About Learning, Inc. Training will be subjected to periodic review for construct and concurrent validity, reliability, career relationships and relationships to the specific outcome variables described earlier in this document.

Linda Lippitt, Ph.D  
Director, Research Division  
About Learning, Inc.

# Introduction and Contents

The doctoral dissertation abstracts and articles contained in this review of the literature are drawn from Dissertation Abstracts International (DAI), The Educational Resource Center (ERIC) System and “field research” conducted by the About Learning, Inc. Department of Research. **These studies are intended to provide for practitioners an overview of the research constructs that have been used to analyze and further validate the 4MAT System for Teaching, Learning and Leadership.**

ERIC: <http://www.ed.gov/EdRes/EdRed/ERIC.html>  
UMI Dissertation: 1-800-521-0600 <http://www.umi.com>,

Additionally, these studies are intended to encourage replication and new research on the 4MAT System. Anyone interested in conducting research on The 4MAT System is encouraged to contact Dr. Linda Lippitt, Director of Research for About Learning, Inc., 505-820-7143, [linda@aboutlearning.com](mailto:linda@aboutlearning.com).

It should be noted, that not all of the dissertation studies listed here were conducted in consultation with Dr. Bernice McCarthy or About Learning, Inc. research staff. In this light, inclusion in this document does not indicate that the study meets the standards of research established for About Learning research projects, nor does it mean that the findings are consistent with other studies of the same nature. Studies are selected for this review solely on the basis that they used the 4MAT System as one component of the research.

Studies are listed alphabetically by author.

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# Historical Perspective

## Historical Perspective: Major Theories Modeled in The 4MAT System for Teaching Learning and Leadership

*Clif St. Germain*

Bernice McCarthy's 4MAT® System is a teaching model which combines the fundamental principles of several long-standing theories of personal development with current research on human brain function and learning. This working paper briefly summarizes these theories and research studies and describes the nature of their contribution to McCarthy's model for teaching. Readers are invited to select, according to interest, among the independent sections of this paper.

Section One summarizes prominent theories of personal development which have greatly influenced the ideology and validation of The 4MAT Model. The fundamental assumption of The 4MAT Model, **that humans learn and develop through continuous, personal adaptations as they construct meaning in their lives**, is derived from the work of John Dewey, Carl Jung and David Kolb. Included in this section are references to basic assumptions modeled for Dewey and brief descriptions of Kolb's Experiential Learning Theory, and Jung's Theory of Individuation.

Section Two traces the historical evolution of the concept of cerebral asymmetry and references studies which have particular applications for teaching-learning situations. Specifically addressed are results of recent studies as to the nature of hemispheric specificity and its significance as an aspect of human individuality and personal development. Also included in this section are findings which document relationships between cognitive style, gender, and handedness, and hemispheric specificity. These studies provide considerable support for Bernice McCarthy's inclusion of hemispheric specificity, a factor influencing teaching and learning environments.

The final section of this paper, Section Three, is written specifically for practitioners and consultants. It contains summary descriptions of the eight steps of Bernice McCarthy's 4MAT Model. Also Included in these descriptions of The 4MAT Model are explanations of those concepts which, each in their own way, reinforce the seminal message of 4MAT... *“that the essential connectedness of knowledge and experience can never be omitted without consequence to the development and individuality of the learner.”*

*Special note:* Bibliographic notations have been omitted to facilitate ease of reading. A bibliography of suggested readings is provided in section 7.

### Section One: The Centrality of Experience and Individuality in Learning

#### The Pedagogy of Instrumentalism

*John Dewey*

At the turn of the twentieth century, the bulk of accepted research on human cognition and learning focused upon discovering general laws of human knowing or principles of intelligence. Various investigations of mental ability generated statistical methods for ranking human beings in terms of their intelligence. At this time, most theorists supported the view that intelligence was biologically determined and was virtually synonymous with specific forms of abstract thinking. Implicit in this “locked in” view of intelligence was the assumption that this intelligence trait, once identified, set the parameters for, and in fact predicted, an individual’s potential. Thus schools, especially institutions of higher learning, were promulgated to identify and train promising students in the rigors of abstract conceptual thought.

However, concurrent with the advent of the scientific revolution many theorists and researchers began to challenge as incomplete this view of human intelligence and learning. Scientific inquiry prompted a change in man’s view of himself and the nature of his intellect. Concurrent with the advent of this scientific revolution was a shift away from the sole emphasis upon the acquisition of abstract ideas, to the scientific verification of ideas in actual experience. This shift, although traceable through several stages of development, can be attributed in large measure to John Dewey and forms the basis of his efforts to reform the American education system. For Dewey, schools were testing grounds for thought. He added creating and testing ideas in experience to the role of the school.

In 1916 Dewey wrote *Experience and Education*, in which he asserted that all learning required the transactional interaction between the individual and the environment. Dewey’s biology-based theory made a case for learning by doing instead of learning by abstraction or rote. Thus he preferred the word “*instrumentalism*” as a description of his philosophy of education which emphasized the testing of the practical consequences of ideas. For Dewey, experience, the interaction of the individual with the environment as a testing ground for ideas, is paramount.

In 1933 Dewey published *How We Think*. This book described his five-step method for thinking which involved: (1) reflecting upon a problem, (2) establishing the limits or characteristics of the problem in precise terms, (3) testing possible solutions and postulating a wide range of hypotheses, (4) considering possible outcomes and acting on these considerations, and (5) acceptance or rejection of the solutions. Dewey’s stages of thinking were designed to systematize a “method” for working through each human experience as it arose. His work in the Laboratory School at the University of Chicago documents this system as a pedagogy and demonstrates its applications for testing ideas in the context of real-life experiences.

It should be noted here that John Dewey’s philosophy of education emphasized the importance of human experience as a gateway to human understanding. To this end, Dewey wrote extensively about the interconnectedness of scientific, social, esthetic and moral aspects of education. His writings clearly reflect his belief in the “consummatory educational experience,” one in which both the individual and the environment are in harmony. History credits John Dewey with the introduction of a pedagogy which unites the mind and the body of the learner through a method of thinking and doing, an experience he called the supreme art form... the art of education.

John Dewey, is a significant contributor to the the 4MAT System. His dictum that developmental education required the provision of experiences which inform the learner of the limits and con-

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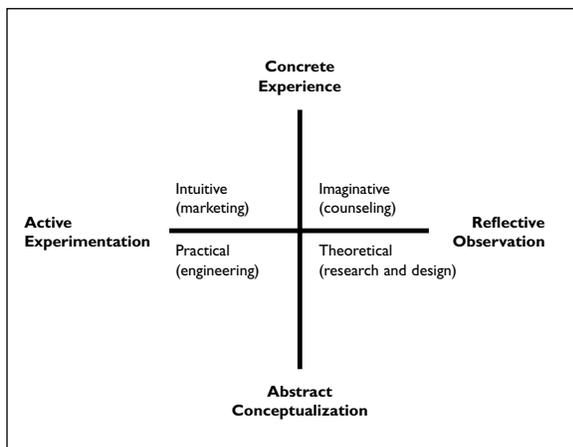
traditions of his/her way of constructing the world is modeled throughout the eight steps of The 4MAT System. Also modeled as a guiding principle of 4MAT is the role of the teacher as one who fosters over a shorter period of time that development which would be natural over the course of an individual's lifetime. These principles and their application to teaching/learning situations are described in some detail in section three of this paper.

Today, researchers are confirming the significance of personal experience in the deployment of brain function and cognitive abilities. Using recently developed brain scan technology it is now possible to document that the human brain, although "hard-wired" to function in specific ways, is also incredibly flexible in the deployment of these functions. As a result of these studies, there is growing evidence that each human being perfects a specific set of cognitive operations (and not others) as a result of personal adaptations to his/her life experiences. These cognitive operations, often referred to in the literature as intellectual potentials, result in high levels of competence in diverse areas of human endeavor. Additionally, there is also support that the human brain continues to adapt and expand for the lifetime of the individual. From this broader perspective, *that cognitive potential is not hidden in the mind awaiting perfection; rather, it evolves and diversifies through use*, it is clearly supportable that John Dewey's insights about the importance of experience in learning were accurate.

## Experiential Learning Theory: A Lifelong Cycle of Learning and Development

David Kolb

Another widely researched, experience-based theory of human learning and personal development is David Kolb's Experiential Learning Theory. Also based on an expanded view of human intellectual capacity which involves testing ideas in actual experience, Experiential Learning Theory focuses on those adaptive modes of thinking from which productive lines of thought and action can be fashioned. According to Kolb human learning and personal development are synonymous processes which involve the continuous integration of a distinct set of independent systems that give meaning to life's circumstances. Kolb specifically names these systems (or modes) as follows: Concrete Experiential (CE) , Reflective Observation (RO), Abstract Conceptual (AC), and Active Experimentation (AE).



At the heart of Kolb's theory is the conviction that learning is a continually recurring process

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through which individuals refine and integrate basic adaptive modes for perceiving, thinking, acting and feeling. The major assumptions of the Kolb Model include the following: (1) learning is a continual process, not an outcome, (2) learning is grounded in personal experience, (3) learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world, and (4) learning involves transactions between the individual and the environment whereby experiences are transformed into knowledge and actions. For Kolb, learning is the constant, all encompassing central life task, and how one learns becomes a major determinant of personal development.

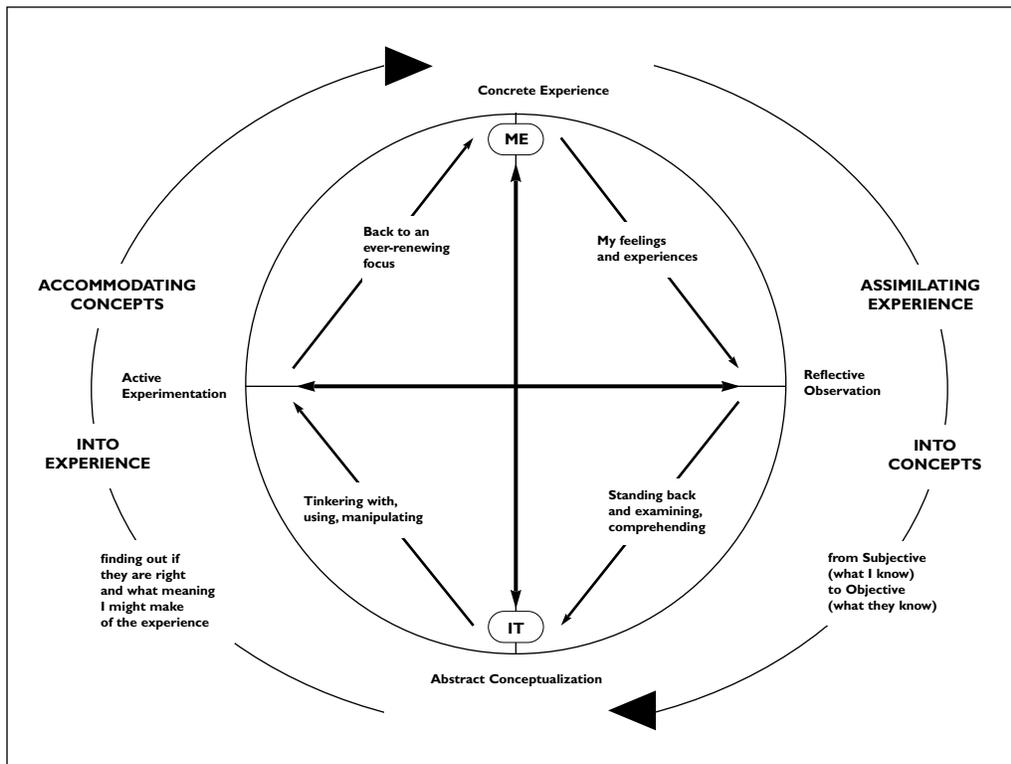
According to Kolb, Experiential Learning Theory is a holistic concept that objectifies the resolution of tensions between basic modes of personal adaptation. Kolb's theory is, therefore grounded in the idea that individuals attain higher levels of cognitive complexity through the integration of preferred and less preferred modes of adapting their personal circumstances.

### Cycle of Learning

David Kolb's Cycle of Learning is the theoretical basis for the 4MAT Model. According to Kolb, adaptations to the environment proceed through a naturally recurring dialectic which begins with a valuation of the learner's prior experience. This valuation, (usually an affective judgment), creates the context for engaging perception through observation and reflection. These observations enable the learner to move to a second stage in the process which is oppositional to affect and personal experience, a stage which requires a shift away from affect toward conceptual abstraction and the construction of a validated theory. From the construction and assimilation of this theory, the learner proceeds to the testing or third stage of the cycle in which implications for behavior are determined. The testing phase is oppositional to perception and reflective observation. The cycle completes itself with the integration of these implications into a newly constructed synthesis which forms a composite for action.

Thus Kolb's Experiential Learning Model describes a process through which the four modes of human experience are engaged at various levels of complexity to create more complete levels of understanding. For Kolb, the adaptive engagement between and among the modes of concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE) is prerequisite to learning and personal development. For example, one might view a problem exclusively from the perspective of personal experiences with this problem or those problems considered to be similar, or one might view a problem from what has been verified by experts about the nature of the problem. The decision to trust one adaptive strategy over the other is personal. One might also attempt to resolve the problem by reflecting upon it and designing a plan, or by manipulating and testing applications until a solution can be found. Balance and experience with all four of these adaptive learning modes is the basis of Kolb's theory. Simply stated, according to Kolb, "individuals expand their learning and adaptive processes through exercising them."

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Additionally, according to Kolb, when contrasting world views are consistently resolved through the suppression of one mode and the reliance upon its opposite, learning tends to become automatized around the trusted mode and limited in those areas which are suppressed. The result is a preferred “style” for learning. Kolb asserts, “ over time, accentuation forces operate on individuals in such a way that the dialectic tensions between these dimensions are consistently resolved in a characteristic fashion. Some people develop minds that excel at assimilating disparate facts into coherent theories, yet these same people are incapable of, or uninterested in, deducing hypotheses from the theory. Others are logical geniuses but find it impossible to involve and surrender themselves to an experience... Each of us in a unique way develops a learning style that has some weak and strong points.”

Kolb has also popularized a classification system which identifies four basic learning “styles” which are described as follows:

- Divergers ( CE+ RO) rely upon their concrete experiences and process these experiences reflectively;
- Assimilators (AC+RO) rely upon theories and abstract conceptualizations which they process reflectively;
- Convergers (AC+AE) rely upon abstract conceptualizations of the world, and process these them actively;
- Accommodators ( CE+AE) rely upon their concrete experiences and process them actively.

Using these four learning styles Kolb articulated his concept of *environmental learning press*, the idea that differentiated complexity inherent in each environment facilitates a particular type of adaptation. According to Kolb, a situation that demands experimenting with behavioral alternatives enhances and reinforces active experimentation. Hence, for Kolb, a particular task or

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environment may be particularly fertile for enhancing one or another generic adaptive competence. Kolb reports that his examination of these four styles of learners in careers reveals that Divergers are over-represented in social professions, Assimilators in science-based professions, Convergers in natural science/ mathematics careers and Accommodators in humanities and social science. Again, one expands his/her learning and adaptive processes through exercising them, according to Kolb:

“Divergers are apt to turn aside the challenge and tedium of abstract analysis in favor of pursuing new excitements, or to resist and delay making the decisions required for taking action when it is called for. Convergers, on the other hand, are apt to ignore or stereotype others in favor of applying abstract principles to problem solving. The former often defends against symbolic and behavioral complexity, while the later defends against the affective and perceptual. Accommodators and Assimilators likewise have their ways of reducing and defending against kinds of complexity with which they are ill-equipped to deal.”

### Principles of 4MAT modeled in Kolb

David Kolb's Experiential Learning Theory, specifically his cycle of interaction between Concrete Experiential (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE) modes of personal adaptation, *is the theoretical basis for The 4MAT System for Teaching, Learning, and Leadership*. McCarthy credits Kolb for the structure upon which she built her model. And while McCarthy has slightly changed the articulation of Kolb's theory to incorporate other theories and to reflect more recent research, each change was an extension of rather than departure from, Kolb's original dictum that individuals expand their adaptive processes through exercising them.

Theoretical models which categorize individuals as one type or another are appealing to some and are odious oversimplifications to others. Nevertheless, different classification systems have been fruitful as general descriptions of human behavior. Most psychologists use the term “personality” to describe the full complex of reactions which distinguish an individual from others. Personality is distinguished from “type” in that type deals with individual reactions (or predisposition) to specific events. In this way, cognitive or learning type classifications like McCarthy's Learning Type Measure and Kolb's Learning Style Inventory are, by design, limited to learning.

It is noteworthy here that the functions and descriptions of the four adaptive modes described in Kolb's Experiential Learning Theory have survived the test of twenty years of implementation. Applying Kolb's theory, McCarthy demonstrates that her model effectively orchestrates a repertoire of specific teaching/ learning sets which balance tensions between concrete experiential and abstract conceptual orientations. The comprehensive quality and depth of these learning sets, especially their articulation in practical language, are McCarthy's contribution to the expansion of Kolb's theory. McCarthy's model also provides for balance between reflective observation and active experimentation through specified variations in teacher/learner interactions. Learning by validating preferred modes of adaptation while stretching to less preferred modes are clearly unifying principles in both Kolb's and McCarthy's models.

There is a difference between Kolb's theory and McCarthy's Model in the way learning style is classified. For Kolb, individuals are classified into one of four learning styles based on a mathematical computation which derives from the individual's score on a self-report instrument which measures preferences for perception and processing. This style is then described in terms of individual behaviors. McCarthy emphasizes the independent yet related nature of all four of

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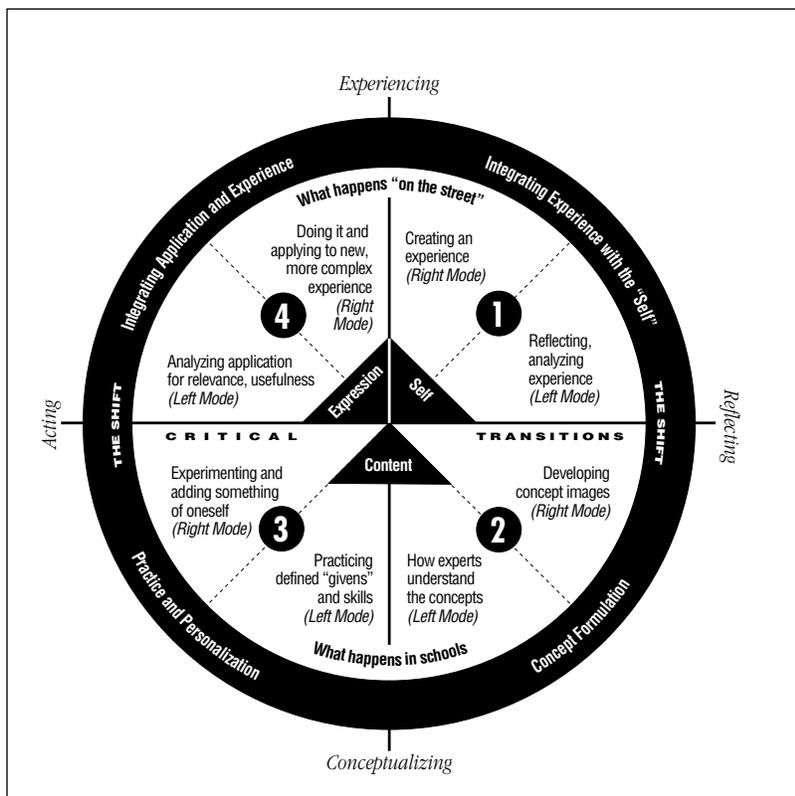
Kolb's aspect of style. She describes a leading adaptive mode, two supporting modes and a least preferred mode. Using her 4MAT Model, McCarthy draws attention to the commonalities in learning that individuals share, while also indicating the extent to which the behaviors of others must be accommodated.

In this way McCarthy applies Kolb's constructs to help individuals compare their composite profile to the specific task requisites in any endeavor (Kolb's Environmental Press) and then make decisions about employing their preferred modes while managing or stretching less preferred modes.

Therefore, McCarthy resists the temptation to classify learners in terms of a single style. In McCarthy's Model, the key issues are the level of differentiation (or preference) and juxtaposition of each of Kolb's four contrasting ways of understanding and acting on life's circumstances.

Also, for McCarthy, each of the four preferences is considered separately in light of its degree of reliance upon reflective or active processing. In essence, McCarthy is saying that individual learning style is the degree to which individuals differentiate and use each of Kolb's four ways of knowing. Style for McCarthy, is the relationship between and among these modes as much as it is the most preferred.

Additionally, when Kolb popularized his Experiential Learning Theory little was known about the influences of hemispheric specificity upon teaching, learning and human development. The inclusion of hemispheric specificity as a further determinant of individual differences in learning is a further extension of Kolb's model by McCarthy. McCarthy, has overlaid a right and left hemispheric variation within each of Kolb's four styles. Again, these additions were not a departure from but a deepening of Kolb's model.



## Historical Perspective

In light of the adaptations of Kolb's model by Bernice McCarthy it is reasonable to examine the measurable commonalities which continue to exist between the two models. In recent years, statistical relationships between Kolb's constructs of CE, RO, AC and (AE) [as measured by his Learning Style Inventory] and the four adapting modes which McCarthy has named quadrant one through four respectively [as measured by McCarthy's Learning Type Measure] have been established and are reported as follows:

Concrete Experiential (CE) is significantly related to Quadrants 1 and 4 as measured by McCarthy's Learning Type Measure (LTM).

Abstract Conceptual (AC) has the highest mean score in Quadrants 2 and 3; however the means were not statistically different from each other

There is a statistically significant difference between LTM quadrant scores on Reflective Observation (RO) comparisons with Quadrant 2 having the highest RO mean score and Quadrant 1 having the next highest mean

There is a statistically significant difference between LTM quadrant scores of Active Experimentation (AE), with Quadrant 4 having the highest AE mean score and with Quadrant 3 having the next highest mean.

From these data it is reasonable to report that

CE is related to Quadrants 1 and 4 (or 12 o'clock in McCarthy's model),

RO is related to Quadrants 1 and 2, (or 3 o'clock in McCarthy's model),

AE is related to Quadrants 3 and 4, (or 9 o'clock in McCarthy's model),

AC is related to Quadrants 2 and 3 (or 6 o'clock in McCarthy's model).

Both Kolb's Experiential Learning Theory and McCarthy's 4MAT Model support the following conclusions:

- individuals learn in different yet identifiable ways;
- differences in learning style, although clearly not related to aptitude, are significantly related to personal motivation and performance;
- learning is a continuous, cyclical, lifelong process of differentiating and integrating personal modes of adaptation; and
- learners expand and refine adaptive modes by exercising them.

## **Individuation:**

### **A Theory for Growth and Personal Development**

*Carl Gustav Jung*

Jung's Theory of Personality Types, like Kolb's Experiential Learning Theory is a holistic theory of human development which assumes the presence of measurable and consistent individual preferences for making sense of the world. Jung postulates that . . . much apparent random variation in human behavior is actually orderly and consistent, being due to certain basic differences in the ways people prefer to use modes of perception and judgment.

For classification of the limitless variations in individual behavior Jung relies upon what he calls the four basic functions: sensing, thinking, feeling and intuition. These functions are opposing modes for making sense of the world. According to Jung, sensing refers to taking in the observable by way of the senses, which tells you something exists; thinking, a term used to define logical decision-making processes, tells you what something is; feeling, a term for the process of appreciation in terms of subjective/personal value, tells you whether something is of value or not; and intuition, a term used for apprehension of meanings, relationships and possibilities by way of insight, tells you when something connects, where it came from and where it is going.

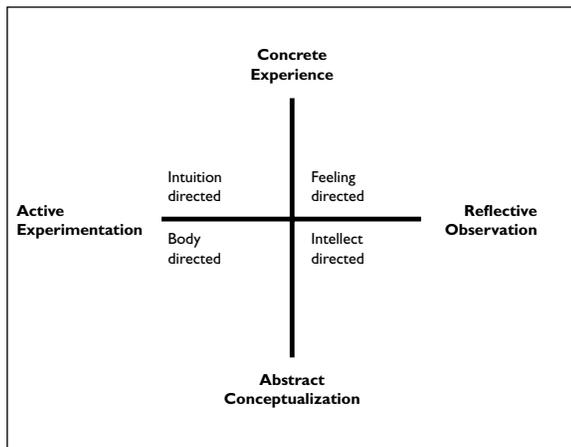
Jung also emphasized that individuals continued to differentiate their personal type (a term Jung used for preferred functions) throughout their lives. According to Jung, a mature individual is one who has developed command of all four functions, elevating two of the four functions to a dominant and auxiliary status and differentiating the use of and respect for the remaining less preferred functions. This process, called *Individuation*, is a cornerstone of Jung's work. Jung defines individuation as a process of differentiation, having for its goal the development of the individual personality."

Jung used the terms extroversion and introversion to describe two basic attitudes toward the environment. Extrovert are individuals who focus attention on objects and people in the environment ,while introverts focus on the consolidation of energy within themselves. Kolb named these attitudes Active Experimentation and Reflective Observation.

A third dichotomy, the judgment-perception preference, added later to Jung's theory by Isabel Myers, discriminates an individual's predisposition for imposing order upon the environment. According to Myers, judging types impose convergent, orderly systems upon their environments. Perceptive types, by contrast, impose personally ordered, divergent systems upon their environment.

Jung's contribution to 4MAT (and subsequently to teaching/learning environments) was his precise descriptions and research on Psychological Types and their preferences in personal development. These descriptions of type were later formalized by Isabel Myers and researched extensively. Isabel Myers, who through development of a standardized instrument for identifying Jungian type preferences (The Myers-Briggs Type Indicator) used Jung's Psychological Types to help teachers understand their students. A compendium of research findings on Jungian Type as measured by the Myers-Briggs Indicator is available through The Center for the Applications of Psychological Type (CAPT) , Gainesville, Florida.

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### Principles of 4MAT modeled from Jung

Jung's Theory of Psychological Type, specifically his concepts of *Individuation*, and *differentiated functions* are modeled throughout The 4MAT System for Teaching, Learning, and Leadership. For example, in 4MAT, learning type is described as the order and juxtaposition of four possible type preferences. These preferences are then reported relationally from most preferred to least preferred. In this way individuals report their preferences for dominant (most preferred), support or auxiliary (second most preferred), third and least preferred. The message here, modeled from Jung is that continued personal development requires the differentiation of less preferred functions and the balance of the individual's type. If Kolb's cycle represents the outer structure of the 4MAT Model, Jung's theory adds text and additional form inside the cycle.

Also, statistically significant relationships have been established between 4MAT learning types as measured by the Learning Type Measure (LTM) and the functions and attitudes of Jungian typology such as Feeling, Sensing, Thinking, Intuition, Extroversion and Introversion. For example, McCarthy's Type One Learner has been statistically correlated with Jungian "Feeling types," Type Two with "Thinking types," Type Three with "Sensing types," and Type Four with "Intuitive types." There is also a significant correlation between the Watching score on the LTM and Introversion and between the Doing score and Extroversion. Types One and Four also report highest means on Perception and Types Two and Three highest means on Judgment as measured by the Myers-Briggs Type Indicator (MBTI).

It should be noted here that while correlation between the individual functions of Jungian typology and 4MAT learning types are supportable, one to one correspondence between the four aspects of Jungian Type (as measured by the MBTI) would oversimplify these constructs and therefore are not to be expected. Jung's theory deals with the wholeness of personality, a constellation of human behaviors, while 4MAT focuses primarily on those behaviors related to the learning process. However, because the requirement to resolve the tension of polar opposites (central to Jung's process of Individuation as well as Kolb's Experiential Learning Model) forms the basis of the rationale for the 4MAT Model, it is reasonable to expect that those constructs drawn from Jungian theory would be related to similar constructs in the 4MAT Model.

## Section Two: Hemisphericity and Human Learning

### Introduction

Four centuries ago, Rene Descartes made a prophetic discovery. He discovered that the brain had a dual organizational structure. He also observed that one small gland, the pineal, was the only aspect of the brain's structure that was not duplicated. From these observations, Descartes proclaimed that the pineal gland was the seat of human consciousness. He based his conclusion on the assumption that the nature of consciousness was unified; therefore, the pineal was the logical choice for the biological storehouse of human consciousness.

After 400 years of investigation, there is still disagreement as to the nature (not to mention physical location) of human consciousness. However, owing to biological observations of scientists from Rene Descartes to Roger Sperry, and to recent advances in technology, the once mysterious relationship between the biological organization of the brain and human learning is, for the first time in history, "researchable."

Today, clinical studies with "split-brain" patients (patients whose two hemispheres have been disconnected for medical reasons), and brain research on normal adults and children using specially developed technologies like Magnetic Resonance Imaging (MRI), Electroencephalogram Scans(EEG), Dichotic Listening Tests and Blood Flow Maps confirm the following:

- (1) that the hemispheres of the human brain process information and experience in identifiably different ways;
- (2) that the neural organization in each hemisphere is complementary yet different;
- (3) that the corpus callosum, the bundle of nerve fibers connecting the two hemispheres of the brain, serves to integrate the actions of the hemispheres;
- (4) that hemispheric specificity and hemispheric disposition (use preference) are quantifiable; and
- (5) that individual preferences for hemispheric integration have clear relationships to cognitive style, especially with regard to learning.

By identifying the specific ways in which the human brain deals with different kinds of information and experience, researchers are uncovering the biological roots of human learning. *Scientific interest in hemispheric specialization, especially attention to the integration of the cerebral hemispheres, (nature's plan for maximizing human potential and intelligence) clearly adds "biological validation" to what once was pure conjecture about how individual differences occur in humans.* Additionally, brain studies have influenced the world view of what it means to "be smart". These findings create the context for a new more complete way of knowing ourselves which is finding its way into workplace systems and even schools. Many of these studies also document striking gender differences in the biology of the male and female brain as well as differences in the ways the sexes orchestrate hemispheric integration.

It is particularly noteworthy that, however promising, much of the research elucidating the biological nature of hemispheric specialization has also been widely criticized as speculative and inconclusive. Much of the criticism is no more than semantic bickering over existing concepts and terms, or disputes about locating intellectual functions in specific areas of the brain. For example, Ralph Strauch, author of *The Reality Illusion*, cautions that the problem with the left/right cerebral model is that, in terms of the metaphor, it is a left-brain description of the workings of the brain. That is to say, it divides the mind into neat, logical categories and encour-

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ages us to believe we understand the working of the brain in analytic terms alone, without using the deeper and softer modes of understanding also available to us.

The real issues that warrant clarification and analysis are those related to the implications and practical applications of this data. The intention here is not to explain the workings of cerebral asymmetry. The goal is to present the facts in an effort to “demystify” one of the most significant discoveries of our time: the biological roots of human individuality.

## Development of Cerebral Asymmetry

There is still little understanding of the reason the human brain developed hemispheric specialization in the first place. Two theories as to how our brain organization evolved are prominent in the literature.

Doreen Kimura and her colleagues have proposed that hemispheric specialization, especially left hemisphere dominance for language, emerged more as a result of the evolution of certain motor skills “ that lend themselves to communication” than as a consequence of the asymmetric evolution of symbolic functions.

Therefore, the left-hemisphere evolved language, not because it was more analytic per se, but because it became well adapted for specific categories of motor activity. Additionally, claims Kimura, the specified spatial skills of the right hemisphere are due to the evolution of different kinds of motor skills, those that involve the ability to manipulate spatial relationships. Using this line of reasoning, handedness would be responsible for the development of aspects of cerebral asymmetry.

Much of the evidence reviewed by Springer and Deutsch suggests that hemispheric asymmetries in some form are present at birth.

Jerre Levy has argued similarly that the cognitive processes used for language and those used for spatial-perceptual functions are incompatible and therefore the brain had to develop separate processing systems. In clinical cases, where one hemisphere is damaged at birth, sensitive tests reveal hemispheric deficits which persist through development, leading to the conclusion that the basic blueprinting for asymmetry is present at a very early age. It is reasonable therefore, to conclude that genetic factors clearly influence hemispheric organization. Studies also confirm that younger children tend to employ a right-hemisphere style until the demands for left-hemisphere processing of language and specificity increase.

Therefore, hemispheric specialization is probably present from birth, but is shaped further by the demands and input to the brain.

## Differences in hemispheric function

According to Springer and Deutsch, the most widely researched and cited characteristics used to describe the processes of the left and right hemisphere are as follows:

<u>Left</u>	<u>Right</u>
Verbal	Nonverbal
Digital	Visuo-Spatial
Sequential	Simultaneous
Rational	Analogical
Logical	Intuitive

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The verbal-nonverbal distinction was the first to emerge from studies of split-brain patients. The sequential-simultaneous distinction has its basis in the fact that the left hemisphere tends to deal with rapid changes in time and to analyze stimuli in terms of detail. The right, on the other hand, deals with stimuli simultaneously through patterns. These differences are widely researched and generally accepted.

Other descriptors which enjoy acceptance in many circles, yet are not as widely researched are the following:

<u>Left</u>	<u>Right</u>
Convergent	Divergent
Deductive	Metaphorical
Realistic	Imaginative
Directed	Free
Explicit	Tacit
Objective	Subjective
Successive	Random
Abstract	Concrete/experiential
Analytical	Holistic

Certainly the importance our culture places on words and verbal knowledge has influenced the idea that because the left hemisphere controls (in large measure) our language capability, it is the important one to develop. However, the right hemisphere houses important activities of its own, activities without which we would be unable to function normally. The right hemisphere appears to play a major role in our ability to perceive relationships and see things as integrated wholes rather than as a collection of isolated parts.

In cases of hemispheric damage in children, when the left is damaged, the right hemisphere is capable of developing language skills, but when the right is damaged, the left hemisphere is not capable of developing nonverbal spatial skills. This also suggests that the right hemisphere is better able to subserve the functions of both hemispheres. Also implied from these studies are speculations that routine tasks are the domain of the left hemisphere while the right hemisphere is assigned tasks for which there is no readily apparent code. Thus the right hemisphere is more flexible and able to handle greater informational complexity.

Robert Ornstein, argues that the cerebral hemispheres are specialized for different types of thought. For Ornstein, differences among people derive not from handedness or sex but from a diversity of different talents or preferences for modes of thought. He also insists that schools spend most of their time training students in what seems to be left-hemispheric talents. This idea, that the two hemispheres are specialized for different modes of thought gave rise to the concept of "Hemisphericity," the idea that individuals rely more on one mode (or hemisphere) than another.

According to Joseph Bogen, a neurologist who originated the term hemisphericity, the relationship between brain function and modes of expression is very complex. Therefore, Bogen warns against simplistic "one or the other" classification systems of brain function. This being said Bogen also confirms that while there is considerable interaction of hemispheric function, language is predominantly processed in the left hemisphere. The division of function is not so much between words and symbols as between logic and emotion. When words are directly linked with emotions, as they are in poetry and song, the right hemisphere is operative. But it is the left hemisphere that deals with the language of conceptual thought.

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### Hemispheric Hardwiring

According to S. H. Woodward, neural patterns in the left hemisphere reflect more tightly connected vertical columns of connectivity, whereas right hemispheric connections reflect weaker and longer horizontal connections. Described as conjunctive (left) and coarse (right) encoding systems these neural patterns differ in that the conjunctive (vertical/left) is designed for highly specific, very compactly organized representations, while the coarse (horizontal/right) is designed for stimulus which is more dispersed and variable.

**Note:** Neurophysiologists have shown that vertical cortical circuitry dominates the response to stimuli. In the absence of specialization, the left hemisphere's specialization deals with all "unmarked" cases. Therefore, the left hemisphere is "hard wired and primary" dealing with tasks requiring fixation. Conversely, the right hemisphere has the role of subserving and dealing with irregularity and complexity. In this way the left hemisphere deals with cases in which rule and regularity are appropriate and the right hemisphere accounts for all irregular or not previously ruled cases.

Goldberg and Costa combined data from studies revealing that there is more tissue in the right hemisphere with studies suggesting an asymmetry in ratio of gray to white matter in each hemisphere. These researchers assert that these studies (of the ratio of tissue and gray and white matter in each hemisphere) support interregional (connected) neural organization in the right hemisphere and intraregional (alone, individual) in the left.

### The Role of the Corpus Callosum

Most experts agree that the corpus callosum functions by updating each hemisphere regarding information received by the other. However, the agreement ends there. Psychologist Norman Cook postulates four possibilities for how the corpus callosum works. These possibilities are as follows: diffuse excitation (arousal of the other hemisphere), topographic excitation (provides carbon copy information to the other hemisphere), diffuse inhibition (shut down of the other hemisphere), and topographic inhibition (activation of complementary aspects of the other hemisphere). Cook believes that the topographic inhibition possibility is most plausible. In topographic inhibition the corpus callosum suppresses in one hemisphere the exact same neuronal pattern of activity that originated in the other, but at the same time allows activity to develop in surrounding neurons representing complementary aspects of the original information.

### Cognitive Style and Hemisphericity

Robert Ornstein has written extensively on three dimensions of brain-related cognitive style: 1) high and low amplification, 2) deliberation-liberation, and 3) approach-withdrawal. According to Ornstein with regard to the high and low amplification measure, individuals differ in a specialized brain setting in the thalamus that controls the amount of amplification and stimulation individuals need. High amplification types need quiet and reflection (because they amplify noise) while low amplification types (because their setting is low) need stimulation and noise. A relationship to Watching/Doing, Reflective Observation/Active Experimentation and Extroversion/Introversion is hypothesized here.

The second continuum reported by Ornstein is the deliberation-liberation continuum. Again, according to Ornstein, individuals are set by their brain organization at different levels of control over their daily actions. They are conditioned by the reticular activating system of the brain and influenced by the limbic system and the frontal lobes of the cortex. Ornstein states, "people differ on how much the emotional brain centers impinge on their day to day lives and how easily they keep different parts of their lives apart. For highly controlled, often highly verbal people,

## Historical Perspective

everything in its place, comes naturally, while a more diffuse style is the norm for others, even when not wanted. The more diffuse style is also associated with how intense and changeable someone's emotional responses are." For those of us who understand 4MAT, the type 2 and 3 would be similar to the deliberation style and type 1 and 4 the more emotional, liberation style.

The third aspect of type which Ornstein describes is the Approach/ Withdrawal continuum. This continuum, located in the frontal lobes of the two hemispheres, is said to establish "feeling tone" in individuals and is defined as the degree of emotional responsiveness a person displays with regard to situations of pleasure and pain. According to Ornstein, pleasure is located in the left hemisphere and pain in the right. I have some difficulty with the terms Ornstein uses to differentiate these behaviors. For me, the continuum would be clearer if considered in light of situations for which there is ambiguity and risk (right hemisphere) and situations for which there is a comfort and control based on prior knowledge or experience (left). People experience pleasure when they are in control and also experience a degree of stress when the situation is to be avoided.

**Note:** According to Ornstein, each of these set points are present at birth and while they can be influenced by environment they remain relatively stable through life. However, some people move their set point more than others.

### Gender Differences

In spite of the fact that the majority of the brain's development occurs outside of the womb, there is solid and consistent evidence from scientists that a biochemical influence in the womb determines and directs the structure and function of our brains. Male hormones organize the brain into a male pattern, and the absence of a male hormone means that the brain persists in a female pattern. In describing how the brains of the sexes are different, prominent differences are observable in the organization of the hemispheres. For example, in most females the connections between the hemispheres are more diffuse whereas in most men they are more specific. Most females also have a larger and more bulbous corpus callosum thus facilitating their diffuse organizational pattern and greater facility with using both hemispheres interchangeably. And, finally, in most females verbal functions and emotional centers are located in both hemispheres whereas in most males verbal functions are located primarily in the left and emotion primarily in the right hemisphere.

Results of studies investigating gender differences support the following:

- The difference in visuospatial ability (representing and transforming symbolic information) is the strongest sex difference with most men having greater competence in this area.
- There are also differences in the way men and women visualize themselves in space. Men appear to have superior skill at analyzing space in terms of abstract ideas, while women are superior at remembering how the space was organized.
- Studies also confirm that boys develop their right hemisphere earlier than girls, while girls have earlier left hemispheric lateralization. However, a majority of girls learn to talk before most boys. Females also have better hearing throughout their lives.
- Boys are better with objects in motion, and mathematical relationships, while girls outperform boys at left-hemispheric tasks involving language. Females test better than men on verbal batteries while males do better on mathematical reasoning.
- Boys report being more aggressive than girls and they are also more active, impulsive and mischievous.
- Women are more empathic and develop more intensive social relations. They are more

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sensitive to sound, smell, taste and touch and superior to most men in fine motor movements. Women are also more adept at tuning to peripheral information contained in expressions and gestures and process sensory and verbal information faster. They are also less rule bound than men.

**Note:** Sexual identity tells us nothing about individual mental ability. It is also important to remember that there are females and males that do not fit the general pattern.

### Handedness and hemispheric organization

Most researchers agree that handedness is significant to individuality because of the way the hemispheres of the brain are organized. Many postulate that handedness may even be the reason the brain developed different hemispheres. In most right-handed people the left hemisphere is dominant for language, while spatial and visuospatial skills are directed by the right hemisphere.

History upholds that left handedness is viewed with some degree of suspect. And to make matters worse for left-handed people, their brain organization is usually different.

### Socio-economic status (SES) and hemispheric preference

Dr. Deborah Waber and her colleagues at Harvard University studied 120 fifth and seventh graders from low and high SES backgrounds. All were Caucasian, right-handed and spoke English as a first language. None had been identified as learning disabled. Using a tachistoscope that flashed words and numbers to the right or left visual field (each of which is connected to the opposite side of the brain), they clearly showed that even though both groups got equal numbers of answers correct, the different SES groups used their brains differently to do so. Even when the effects of IQ were statistically controlled, the high SES children showed a clear pattern of using their left hemisphere more effectively, while equally intelligent low SES children tended to rely upon the right. According to the researcher, these results reflected SES-related variations in the nature of information processing in the two hemispheres. Boys and girls scores did not differ from each other. Waber does not believe that her research implies that these differences are immutable, but rather that they may have resulted from differing life experiences.

These findings have prompted a serious challenge to the way human learning has been conceptualized. As Jane Healy, author of *Endangered Minds* warns, in light of recent research, those teaching models which exclusively emphasize the acquisition of abstract knowledge soon run afoul of the developmental reality that brains learn in different ways and on different schedules. According to Healey, many children, because of different orientations to learning, perform poorly in learning environments which do not diversify instructional tasks.

### Summary

Research on hemispheric specialization and brain function support the following:

- The hemispheres of the human brain process information and experience in identifiably different ways.
- The neural organization in each hemisphere is complementary, yet different.
- The Corpus Callosum, the bundle of nerve fibers connecting the two hemispheres, serves to integrate the functions of the hemispheres.

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- Hemispheric dispositions (preference) are identifiable.
- Individual preference for hemispheric integration has a supportable relationship to cognitive processing style, especially with regard to new learning.
- Brain research supports the belief that traditional education favors an all too narrow approach to teaching. Our “at-risk” students may be at risk due to our teaching methodologies rather than from any innate deficiencies of their own.
- Research on the effects of right and left mode instruction indicates that students differ with regard to hemispheric dominance, and that these differences influence student retention and performance.

According to these findings most researchers support the idea that thinking and learning calls upon both hemispheres. Therefore, when teachers mix and match the abilities of the two hemispheres so that the most adaptive processing is brought to bear on the learning situation, learner motivation and performance improve.

Bernice McCarthy, author of the 4MAT System, believes that polarized classification abuses of the (Hemisphericity) research do not negate the need for teachers to understand and apply this research. According to McCarthy, teachers need to intentionally design instruction to incorporate the processing skills of both hemispheres in order for learning to be complete. They must understand the right and left mode functions of the brain and they must do so as mindfully as possible.

McCarthy’s 4MAT gives all who teach a context for understanding and applying these findings to their individual settings. Conversely, brain research validates the 4MAT System. Therefore, according to McCarthy, it is important that all who teach become conversant with these studies and understand their implications for teaching and learning.

This knowledge about the specialization of brain function has led to several hypotheses about how teaching and learning might be improved. In this regard, the guiding principles of the 4MAT Model relating to hemisphericity are as follows:

- Individuals rely more on one mode of processing than another,
- We can characterize these modes of processing as right or left hemispheric dominant,
- Whole brain learning (engaging right and left hemispheres), a goal of The 4MAT Model, is accomplished for different individuals with different methods.

Simply put, meaningful teaching requires that teachers design learning sets which engage both right and left hemispheric abilities.

## Section Three: Bernice McCarthy's 4MAT Model

Bernice McCarthy, drawing heavily upon these brain studies and grounded in the work of John Dewey, David Kolb and Carl Jung, has created a pedagogical model which assumes (1) that individuals learn in different yet identifiable ways, and that (2) engagement with a variety of diverse learning sets results in higher levels of motivation and performance. The following summaries of Kolb's Theory of Experiential Learning and Jung's Theory of Individuation are presented here as examples of the theoretical origins of McCarthy's model.

McCarthy's 4MAT System applies the principles of these long-standing theories to provide teachers with a structure for planning meaningful learning experiences for all "styles" of learners. According to McCarthy, 4MAT deepens the experience of learning by engaging learners in diverse learning sets which require the learner to form and test the limits of his/her understanding. McCarthy's 4MAT System, an eight step model for teaching, is summarized as follows:

### Step One — Quadrant I Right

The first step of The 4MAT System is designed to engage the learner in a concrete experience which leads to a search of prior knowledge and prior experience. This search is designed to create an interactive group dialogue which connects what the learner already knows and believes to what the teacher intends to teach. In this dialogue there are no correct answers. Learners experience and compare their perceptions of their existing state of knowledge and work cooperatively to create an overall learning set from which to proceed. In this step the teacher encourages diversification of ideas, dialogue and participation. Note McCarthy's application of Kolb's concrete experience and reflective modes for making sense of the learning environment, as well as the engagement and encouragement of subjective valuation, Jung's feeling function. This step is also designed to encourage relational, symbolic thinking which is a right hemispheric function.

#### *Suggestions for teachers*

- Connect students directly to the concept in a personal way.
- Capture students' attention by initiating a group problem-solving activity before delivery of instruction.
- Begin with a situation that is familiar to students and builds on what they already know.
- Construct a learning experience that allows diverse and personal student responses.
- Facilitate the work of cooperative teams of students.
- Elicit non-trivial dialogue from students .

#### *Evaluation:*

Engagement, participation in collaborative dialogue and generation of ideas.

### Step Two— Quadrant I Left

The second step of McCarthy's 4MAT System, quadrant one left, is designed to add process judgment to the perceptions and dialogue generated in step one. In this teaching set, the teacher engages student reflection upon their existing level of their knowledge and experience to determine if their opinions and beliefs are supportable. The emphasis here is not to qualify or bring closure to student thinking. In quadrant one (right and left) the goal is engagement. However,

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in quadrant one left the teacher's role is to assist student as they demystify and pattern their thinking. In quadrant one left, beliefs and opinions begin to evolve into organizers and structures for future thinking and theory building. This phase of The 4MAT Cycle emphasizes left hemispheric thinking and therefore has as its goal the imposition of structure.

### *Objective:*

Examine the Experience.

### *Suggestions for teachers*

- Guide students to reflection and analysis of the experience.
- Encourage students to share their perceptions and beliefs.
- Summarize and review similarities and differences.
- Establish a positive attitude toward the diversity of different people's experience.
- Clarify the reason for the learning.

### *Evaluation:*

The quality of students' analyses of their collective subjective world of experience. Students ability to explore stated feelings by listening, listing, patterning, prioritizing, stating their own reflections

## **Step Three— Quadrant 2 Right**

Step three of the 4MAT System is designed to create a context for the learner to represent the subjective nature of his/her existing knowledge as a preparation for the validation and analysis of ideas. In this step learners are encouraged to symbolize, in as many modalities as feasible, their present state of understanding of the subject matter. Image making, central to this step, is a right mode activity. The emphasis here is the expansion of representations of meaning. However, this step requires the learner to begin to shift from reflective experience to reflective thinking. The teacher's role here is to draw attention to aspects of structure and objectivity implicit in the students representations of what they know.

### *Objective:*

Integrate personal experiences into conceptual understanding.

### *Suggestions for teachers*

- Provide a metaview, lifting students into a wider view of the concept.
- Use another medium (not reading or writing) to connect students' personal knowing to the concept (i.e. visual arts, music, movement, etc.).
- Involve learners in reflective production that blends the emotional and the cognitive.
- Transform the concept yet to be taught into an image or experience, a "sneak preview" for the students.
- Deepen the connection between the concept and its relationship to the students' lives.
- Relate what the students already know to what the experts have found.

### *Evaluation:*

Quality of student production and reflection

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### Step Four— Quadrant Two Left

Step four of the 4MAT System engages students in objective thinking. The emphasis here is analysis of verifiable concepts, facts, generalizations and theories. The role of the teacher is to present information and experience in complete and systematic ways. The good “two -left” lecture builds upon the personal connections established in quadrant one to foster conceptual thinking. This is a left mode teaching set. Note: This is McCarthy’s application of Kolb’s abstract conceptual, reflective mode as well as Jung’s thinking function.

#### *Objective:*

Define theories and concepts.

#### *Suggestions for teachers*

- Provide “acknowledged body of knowledge” related to the concept.
- Emphasize the most significant aspects of the concept in an organized, organic manner.
- Present information sequentially so students see continuity.
- Draw attention to important, discrete details; don’t swamp students with myriad facts.
- Use a variety of delivery systems: interactive lecture, text, guest speakers, films, visuals, CAI, demonstrations, etc. when available.

#### *Evaluation:*

Teacher verbal and/or written checking for student understanding

### Step Five— Quadrant Three Left

In step five of the 4MAT System the emphasis shifts from acquisition and assimilation to testing and adaptation. Students now take the lead to apply what has been taught. In quadrant three left the goal is reinforcement and diagnostic evidence of the student’s ability to apply the concepts taught. The teacher’s role here is coaching and assisting as students refine their ability to find applications of their ideas. This teaching set engages Kolb’s abstract concepts in action and Jung’s extroverted sensing functions. It also models Dewey’s idea that knowledge must be tested in the environment. Because the emphasis of this teaching/learning set is left mode, correct answers and student products which demonstrate their ability to apply the concepts are important here.

#### *Objective:*

Working on Defined Concepts (Reinforcement and Manipulation)

#### *Suggestions for teachers*

- Provide hands-on activities for practice and mastery.
- Check for understanding of concepts and skills by using relevant standard materials, i.e. worksheets, text problems, workbooks, teacher prepared exercises, etc.
- Provide opportunities for students to practice new learning, perhaps in multi-modal ways (learning centers, games fostering skills development, etc.)
- Set high expectations for skills mastery.
- Use concept of mastery learning to determine if re-teaching is necessary and how it will be carried out.
- Have students create additional multi-modal practice for each other.

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## *Evaluation:*

Quality of student work, perhaps an objective quiz

## **Step Six— Quadrant Three Right**

Step Six of The 4MAT System exemplifies John Dewey's idea of the student as a scientist. In this learning set the student tests the limits and contradictions of his/her understanding. The teacher's role is to encourage students to take the application of learned ideas to more sophisticated, personal levels. Students are encouraged to develop their own applications which demonstrate that they understand and can apply what has been learned. Project work is the essence of this phase of the 4MAT Model. The right mode emphasis in this learning set is designed to encourage students to create personal applications their experiences with the ideas learned.

## *Objective:*

“Messing Around” (Adding Something of Themselves)

## *Suggestions for teachers*

- Encourage tinkering with ideas/relationships/connections.
- Set up situations where students have to find information not readily available in school texts.
- Provide opportunity for students to design their own open-ended explorations of the concept.
- Provide multiple options so students can plan a unique “proof” of learning.
- Require students to organize and synthesize their learning in some personal, meaningful way.
- Require students to begin the process of planning how their project will be evaluated, identifying their own criteria for excellence.

## *Evaluation:*

Students on-task behavior and engagement in their chosen options

## **Step Seven— Quadrant Four Left**

Step seven of The 4MAT System requires the learner to critically examine the place of the newly acquired knowledge and experience in his/her existing world view. The central issue here is what new questions do I have and what must be done to integrate this learning into a meaningful conceptual subset. Working alone or preferably in pairs and triads, learners in this learning set edit and refine their work. They also face and resolve contradictions implicit in the tension between new and earlier schema. The teacher's role here is to guide the refinement of the old schema and encourage the formation of a more complete perspective. Note the requisite of this step to objectify intuition.

## *Objective:*

Evaluating for Usefulness and Application

## *Suggestions for teachers*

- Give guidance and feedback to students' plans, encouraging, refining, and helping them to be responsible for their own learning.

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- Help students analyze their use of the learning for meaning, relevance, and originality.
- Maintain high expectations for completion of chosen options.
- Help mistakes to become learning opportunities.
- Summarize by reviewing the whole, bringing students “full circle” to the experience with which the learning began.

### *Evaluation:*

Students’ willingness and ability to edit, refine, rework, analyze, and complete their own work

### **Step Eight— Quadrant Four Right**

The essence of step eight in The 4MAT System is integration, celebration and closure. In this, the last of McCarthy’s learning sets, the learner returns to the place where he/she began, the self, and integrates the learning experience into a slightly different, personally held world view. This is the step where presentations are given, where poems are recited, where letters are mailed and research reports submitted. The teacher’s role is to join in the celebration and facilitate entry into the next unit of study.

### *Objective:*

Doing it Themselves and Sharing What They Do with Others

### *Suggestions for teachers*

- Support students in learning, teaching, and sharing with others.
- Establish a classroom atmosphere that celebrates the sharing of learning.
- Have opportunity for students to practice new learnings.
- Make student learning available to the larger community, i.e. books students write are shared with other classes; students report in school paper; student work is displayed throughout the school; etc.
- Leave students wondering (creatively) about further possible applications of the concept, extending the “what ifs” into the future.

### *Evaluation:*

Students ability to report and demonstrate what they have learned. Expressions of student enjoyment in the sharing of their learning. Quality of student final products.

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## Research Support

Bernice McCarthy and her associates have conducted extensive action research on the effects of the 4MAT Model. Their work clearly demonstrates that 4MAT, appropriately used: (1) validates learners, (2) increases learner motivation, (3) improves academic performance and (4) encourages personal development by intentionally representing experience and knowledge in varied yet connected ways.

Dissertations and action research investigating the specific effects of the 4MAT Model indicate that appropriately used, 4MAT positively impacts the following:

- Levels of student involvement on academic learning tasks
- Attitude and achievement in science
- Reduction in remediations necessary for student mastery
- Student self-esteem and behavior
- Attitude and achievement in fine arts
- Acquisition of study skills strategies
- Performance in geometry
- Performance on standardized tests
- Retention on content measures
- Interest and attitudes to instructional activities in science
- Teacher implementation of innovation using 4MAT
- Teacher attitudes toward diversity
- Teacher purposefulness and planning
- Teacher employment of diverse learning sets
- Teacher transfer of teaching innovations
- Incorporation of creativity in teaching
- Adult learning and retention

Therefore, many validated studies provide convincing evidence that 4MAT can have positive and significant effects upon student performance and attitude. Also that s a model for staff development, 4MAT is philosophically, theoretically and structurally suited to the development of purposeful, creative unit plans.



## Pre-K–Elementary Dissertations

- Author: Appell, Claudia Jane
- Title: The Effects of the 4MAT System of Instruction on Academic Achievement and Attitude in the Elementary Music Classroom
- School/Degree: University of Oregon/Ed.D.
- Date: 1991
- Abstract: The primary purpose of this study was to evaluate the effects of the 4MAT System of Instruction on student achievement and attitudes. The subjects were fifth grade students who attended schools outlying the metropolitan area of Portland Oregon. Eight teachers were randomly placed in either the 4MAT or textbook group. Four teachers and 87 students were in the textbook and the additional four teachers and 67 students participated in the 4MAT group.
- The 4MAT lessons were based on Bernice McCarthy's eight step instructional model. The textbook lessons were structured as the lessons in the Centennial Edition (1985), Silver Burdett, grade 5, rhythm unit. The eight lessons were taught in nine consecutive instructional sessions. Attitude was measured using an instrument designed by the author.
- The achievement hypothesis was investigated using two group, pretest, posttest experimental design. The results of the pre- and post tests and the attitude survey were analyzed using a t-test with significance established at the .05 level for one-tailed comparisons. The mean difference in achievement scores between the two groups indicated the students in the 4MAT group achieved significantly greater gains than students in the textbook group. There was no significant difference between attitudes in both groups.

## Research in Pre-K through 12 School Settings

- Author: Bowers, Patricia Shane
- Title: The Effect of the 4MAT System on Achievement and Attitudes in Science
- School/Degree: The University of North Carolina at Chapel Hill/Ph.D.
- Date: 1987
- Abstract: The purpose of this study was to investigate the effects of the 4MAT instructional system on achievement and attitudes in science. Fifty-four academically gifted sixth grade students in three schools in the Chapel Hill-Carrboro (North Carolina) City Schools were randomly assigned to two groups: a 4MAT Group or a Restricted-Textbook group that utilized only left-hemisphere activities. Both groups were taught a three-hour unit on Newton's First Law of Motion.
- The dependent variables for investigating the effects on achievement were the overall score and the knowledge and critical thinking subscores on an investigator-made achievement test given at the conclusion of the unit of study. Group means were compared using a one-way analysis of variance. Significant differences favoring the 4MAT group were found for overall achievement ( $F(1,52) = 6.19, p < .05$ ) and on critical thinking questions ( $F(1,52) = 13.07, p < .001$ ). No significant differences were found on knowledge-level questions.
- The dependent variables for investigating the instructional effect on attitudes were the ratings on unit-specific statements and statements about science in general. Mean group ratings for each score were compared using a one-way analysis of variance. Significant differences favoring the 4MAT group were found when analyzing the unit-specific statements. Significant differences favoring the Restricted-Textbook group ( $F(1,52) = 5.33, p < .05$ ) were found when analyzing the unit-specific statements. Significant differences favoring the Restricted-Textbook group ( $F(1,52) = 5.33, p < .05$ ) were found when analyzing the statements about science in general.

## Research in Pre-K through 12 School Settings

- Author: Hancock, Carol Wilcox
- Title: Impact of the 4MAT Lesson Planning System on the Number of Times a Teacher was Off-task in a Fifth, Sixth and Seventh Grade Classroom
- School/Degree: Baylor University, Ed.D..
- Date: 2000
- Abstract The primary purpose of this study was to evaluate the effects of the 4MAT Lesson Planning system on the number of times a teacher was off-task in a fifth, sixth or seventh grade classroom. Three classroom teachers, one at each level, were observed over a 20 day period by three trained observers to obtain data describing the actual number of times each teacher was off-task in a 25-minute period. Off-task teacher behavior was defined as any redirection of teacher attention by a student that pulls the teacher's focus from the topic he or she was currently teaching or discussing. The program under review was the 4MAT Lesson Planning System designed by Bernice McCarthy (1980) to reflect current brain theory and research, learning styles, and left and right modalities in a lesson planning system. A review of the current literature revealed that brain research on how students learn, brain hemisphericity, and learning styles contributed to an enhanced view of how learners actually learn. Teacher accountability and student off-task , disruptive behaviors have been areas of great concern in education. Teacher off-task behavior has been tied to student off-task behaviors which consumes teacher time and attention during class. Research demonstrates that student off-task disruptive behavior was reduced when students are actively engaged in lessons. This study demonstrated a reduction in the number of off-task behaviors in the classrooms where the teachers were using the 4MAT System Lesson Planning System. Implications exist for the use of organize, structured lesson plans focused on student engagement .

## Research in Pre-K through 12 School Settings

Author: Madsen, Kim Ann, Ed.D.  
Title: An Examination of Multiple Intelligences Exhibited by Preschool Children in a Child Care Center  
School/Degree: University of Nebraska/Ed.D.  
Year: 1996  
Abstract: The purpose of this qualitative study was to determine if multiple intelligences were exhibited by preschool children between the ages of two and four while attending a child care center in western Nebraska.

The research goals for this qualitative study were to discover whether preschool children exhibited preferences for multiple intelligences (especially the seven intelligences identified by Howard Gardner) and if those preferences parallel a specific style of learning (especially the 4MAT learning style model developed by Bernice McCarthy).

The qualitative research process involved the following objectives:

1. Examine multiple intelligences through actual observations, videotapes, and interviews while preschool children were actively engaged in a child care center during self-selection time.
2. To analyze the multiple intelligences of preschool children between the ages of two and four, and identify a probable preference in learning style using the 4MAT model.

A total of twelve children between the ages of two and four were selected to make up the population of this study. The grounded theory qualitative analysis involved the collection of data during self-selection time held between 7:15 and 9:00 a.m. in the child care center. All field work and collection of data through character descriptions, videotapes, logs, observations, and interviews took place in the Chadron State College Child Development Center as preschool children were actively engaged in experiences.

In order to develop the researcher's theory that intelligences may be exhibited by preschool children as young as age two, the researcher documented know characteristics of Howard Gardner's multiple intelligences theory that focused on children almost five years old and older. A documentation of Bernice McCarthy's 4MAT learning styles model was also utilized to assist with determining another portion of the researcher's theory that a relationship exists between intelligences and learning style characteristics.

Based on the findings of this study, it was concluded that individual preschool children exhibited characteristics for at least three multiple intelligences that can be interpreted to describe a relationship between individual or personal learning study.

## Research in Pre-K through 12 School Settings

Author: Vaughn, Vicki Lynn Fulton  
Title: A Comparison of the 4MAT System of Instruction with Two Enrichment Units Based on Bloom's Taxonomy with Gifted Third-Graders in a Pull-Out Program  
School/Degree: Purdue University/Ph.D.  
Date: 1991

Abstract: Pull-out programs are the most widely used models in gifted education and are viewed to be quite controversial. A meta-analytic review of the literature on pull-out programs yielded significant effect sizes for the variables of achievement, critical and creative thinking. The purpose of this study was to determine if The 4MAT System of Instruction would improve the achievement, retention, and creative products of gifted third-graders in a pull-out program when compared to the traditional method of instruction based on Bloom's Taxonomy.

A quasi-experimental design was used for the 99 third-grade students identified as gifted by their school system. Two units of instruction ("Mysteries of the Deep/Oceanography" and "Hans Christian Andersen and Fairy Tales") were taught by teachers trained in gifted education and The 4MAT System.

Pretests, post tests, and long-range post tests developed for the study were administered for each unit. A repeated design measure analysis of variance found no differences between the 4MAT group and the group receiving the traditional method of instruction on achievement or retention. However, a moderate effect size was found on tested achievement for the Fairy Tale Unit. Student projects were rated by the teachers and final unit products were judged by independent raters in an attempt to measure higher-level thinking (synthesis) and creativity. The 4MAT group scored higher than the controls on the final product. Talent Pool teachers were interviewed and the students were surveyed to determine their instructional preferences. Teachers preferred the traditional method of instruction but noted that 4MAT helped to focus their teaching to the important concepts. Students preferred the units and activities using The 4MAT System.

Although The 4MAT System produced no effect for either achievement or retention, it did appear to influence the factor of creativity in the final student products for the Fairy Tale Unit, and students preferred the units that used this method of instruction. Further research is needed to determine if 4MAT can benefit gifted students in a pull-out program.

## Research in Pre-K through 12 School Settings

Author: Wilkerson, Rhonda Morgan

Title: An Evaluation of the Effects of the 4MAT System of Instruction on Academic Achievement and Retention of Learning (Hemisphericity)

School/Degree: The University of North Carolina at Chapel Hill/Ph.D.

Date: 1986

Abstract: The purpose of this study was to evaluate the effects of The 4MAT System, a method designed to address learning styles and hemispheric preferences, on (a) academic achievement and (b) retention of learning. Also examined were (a) students' interest in the content of instruction, science and attitudes toward the unit of study, and (b) teacher perceptions regarding the instructional approaches and student behavior.

The subjects were 50 randomly selected students who attended a public school in the Piedmont region of North Carolina. The students were taught eight one-hour lessons on simple machines. The experimental group was taught using The 4MAT System; the control group was taught using a textbook approach.

After completion of the unit, a two-part achievement test was administered to the two groups. Part A measured achievement classified as knowledge comprehension, application, and analysis; Part B measured achievement classified as synthesis and evaluation. Group means on Part A were compared using a one-factor analysis of variance; significant differences were found favoring the 4MAT group ( $F 1, 44 = 4.06$   $p < .05$ ). Student performance on Part B was scored by raters; group means were compared using a one-factor analysis of variance. There were no significant differences between the means on Part B ( $p > .05$ ).

Thirty-five days after the conclusion of the unit, the same form of the test was administered to both groups. Group means on Part A were compared using a one-factor analysis of variance; significant differences were found favoring the 4MAT group ( $F 1, 46 = 10.10$ ,  $p < .05$ ). Student performance on Part B was compared using a one-factor analysis of variance; no significant relationship was indicated ( $p > .05$ ).

Students' interest in science and attitudes toward the instructional activities were examined using journals and a questionnaire. An analysis of the data indicated that students in the 4MAT group were more interested in the unit, had a more positive attitude toward the lessons, and demonstrated more on-task behavior than did the students in the textbook group.

### Pre-K–Elementary Additional Studies

- Author: Benezra, Susan Horner
- Title: Bernice McCarthy's 4MAT Learning Style Adaptations in Middle School Life Science
- School: Suburban Middle School in St. Louis County, Missouri
- Date: 1985
- Abstract: The purpose of this study was to determine the effect of The 4MAT System on the achievement performance of middle school students. Using seventh grade life science classes in a suburban St. Louis County middle school, the effect of McCarthy's 4MAT System was studied. Comparisons of pre and post achievement scores on a district criterion-reference test indicated improvement in science achievement for all groups. Results of these comparisons also indicate an increase in positive student comments and greater elaboration of projects.

## Research in Pre-K through 12 School Settings

- Author: Hinds, Kelly
- Title: The Effects of 4MAT/Talents Unlimited on Students/Achievement and Attitude
- School: Northern State College, Aberdeen, South Dakota
- Date: August, 1992
- Available From: Northern State College, Aberdeen, P O Box 629, So Dakota, 57401  
c/o Dr. Jerry Harmon
- Abstract: This Masters Thesis studied the effects of 4MAT/Talents Unlimited on Students' Achievement and Attitude
- Fifty-one fifth grade students were randomly chosen and divided into two groups. One group was taught with a textbook approach, the other with 4MAT. The content was a science unit on energy, taught daily for forty-five minutes over a three week period.
- The results suggest that the 4MAT/Talents Unlimited approach to teaching is an effective instructional model for students. Students taught using the 4MAT approach:
1. showed statistical significance in the area of higher level thinking skills over the control group.
  2. responded more favorably toward the lessons.
- Students preferred higher level thinking skills over textbook knowledge and applications.

## Secondary School Dissertations

Author: Jacobsen, Gary-Hans

Title: Incorporating Learning Styles in Mastery Learning Classrooms.

School/Degree: Montana State University/Ed.D

Date: 1986

Abstract: During the first semester of the 1986-87 school year, the researcher conducted an experiment in the Colstrip Public Schools in Colstrip, Montana. The study involved seventh grade students attending the Frank Britton Middle School. The problem of this study was to determine if student achievement could be improved and/or the number of remediations required for mastery reduced by incorporating learning styles into initial instruction in a mastery learning classroom.

Six teachers, representing the subject areas of math, geography, art, industrial arts and language arts were chosen to participate in this study. Each teacher taught an experimental class and a control class. The teachers incorporated learning styles into initial instruction, using Bernice McCarthy's 4MAT System in the experimental group. The control groups were taught initial instruction without learning styles. At the end of the first semester the students were given a CRT achievement test to determine student achievement. The students were also given an attitude instrument to determine if there was a difference in attitude between the experimental and the control groups. The teachers recorded the amount of time taken for initial instruction and the number of remediations required for the students to achieve mastery of the material.

An analysis of variance showed an improvement in achievement in industrial arts, but there was no improvement in achievement in any of the other subject areas. In math, language arts II, art and industrial arts there was a reduction in the number of remediations required for mastery, while in geography and language arts there was no difference in the number of remediations between the experimental and the control group. There was no learning style preference-treatment interaction, nor was there any gender-treatment interaction.

Based on this analysis, the researcher concluded that by incorporating learning styles into initial instruction in mastery learning classrooms, the number of remediations necessary for mastery could be significantly reduced.

## Research in Pre-K through 12 School Settings

- Author: Palatto-Fontaine, Debra
- Title: Effects of the 4MAT System of Instruction on the Self-Esteem and Behavior of Ninth Grade Students (4MAT System of Instruction)
- School/Degree: The University of Connecticut/Ph.D.
- Date: 1989
- Abstract: This study evaluated the effects of The 4MAT System of Instruction on self-esteem and behavior in the classroom. The 4MAT System is an instructional model that provides a systematic approach to organizing and delivering instruction that addresses the learning styles and hemispheric preferences of students.
- The 4MAT Model is one way that educators can ensure success in the classroom and raise competencies that will lead to enhanced self-esteem. Also, when students' unique learning characteristics are recognized, it is assumed that a positive self-esteem will be promoted along with minimal behavioral distractions.
- This study utilized a nonequivalent control group design to examine the impact of The 4MAT System on self-esteem and behavior. The subjects were ninth-grade students attending a public high school in Connecticut. Groups were taught an earth science curriculum using different methods of instruction: The 4MAT System and a traditional lecture/textbook approach.
- The Hypothesis pertaining to overall self-esteem was tested using Analysis of Covariance procedures. No significant differences were found after adjusting the group means, thus the null hypothesis was not rejected.
- To test the hypothesis for determining whether the frequency of high, medium, and low ratings for classroom behavior differed between the two groups, a single-sample chi-square test was performed. Analysis revealed significant differences between the groups and the null hypothesis was rejected.
- Qualitative methodology was included in this study to examine four areas of self-esteem. Data were collected through semi-structured interviews. Differences in themes in the academic area of self-esteem were revealed between the two groups.
- This study has significant implications for educators in the areas of curriculum development, staff development, school effectiveness, and multicultural education.
- Recommendations for further research include replication with students in other grade levels, other subject areas, and the use of additional outcome measures.

## Research in Pre-K through 12 School Settings

Author: Sanborn, Stephen D.

Title: A Study of the Effects of Cross-Age Tutoring Versus Learning Styles Instruction in a Heterogeneous Classroom of Higher Risk Students

School/Degree: The University of Vermont

Date: 1994

Abstract: The purpose of this study was to examine the effect of different instructional strategies on the performance of higher risk secondary school students. The strategies chosen to be studied were cross-age tutoring, an instructional strategy accomplished outside of the regular classroom and 4MAT learning style instruction in a heterogeneous classroom as part of every day instruction. Students from three sophomore global history classes at a local Vermont high school were used for the study. Tutors were education majors from a local university.

A causal/comparative method of study was chosen to investigate the relationship between instructional strategies and student learning attitudes, study skills and academic achievement. Using student grade point averages, the results of the California Achievement Test and the results of the Learning and Study Strategies Inventory (LASSI) data analysis revealed that cross age tutoring had a positive impact upon information processing skills and one measure of academic achievement. *4MAT learning styles instruction had a positive impact upon ten of the fourteen variables used to measure the success of high risk students.*

## Research in Pre-K through 12 School Settings

Author: Susabda, Esther

Title: The Relationship Between Matched/Mismatched Students' Learning Styles To Faculty Teaching Style and Academic Performance in Christian Secondary Schools In Southern California.

School/Degree: Talbot School of Theology, Biola University/Ed.D.

Date: 1992

Order Number: ADG92-24458. 9305.

Abstract: The purpose of this study is to investigate the relationship between students of matched/mismatched learning style and their preferred faculty teaching style with their academic performance among Christian high school students in Southern California. The instruments used were D. Kolb's Learning Style Inventory (LSI) and B. McCarthy's Teaching Style Inventory (TSI).

This study confirmed the findings of the previous studies.

Different students have different abilities and learning styles. Learning style of the average and below average students tended to be more concretely dimensional while superior students tended to be more abstract in their thinking.

The study found that mismatched students with superior academic performance were less dependent on their preferred teaching style than those of matched students with average or below average academic performance. It seemed that superior mismatched students were more independent and able to integrate application and experience by themselves.

Although matched students might adapt to the instructor's teaching style in abstract dimensions, this did not give support to their academic performance. It was indicated that underachievers had different learning style characteristics from those of high achievers. [214 pages]

## Research in Pre-K through 12 School Settings

Author: Szewczyk, Lester

Title: Effects of 4MAT, an Experientially-Based Teaching Method Upon Achievement and Selected Attitudinal Factors of High School Geometry Students

School/Degree: Northern Illinois University/Ed.D.

Date: 1987

Abstract: This study considers the following question: What are the effects of 4MAT, an instructional system integrating experience and perceptual preference upon achievement, attitude, and enrollment intention in advanced mathematics courses of students in secondary school geometry classes?

To investigate this question, four intact geometry classes (80 subjects) from a medium-sized high school near Chicago were assigned to one of two groups, experimental or control, and taught for one semester using either 4MAT processes or traditional methods, respectively. The 4MAT System of teaching/learning was developed by Bernice McCarthy based upon prior work by David Kolb and others. Eight hypotheses were developed reflecting the primary variables of method, achievement, attitude and enrollment as well as secondary attributes of genes, brain hemisphericity and learning style classification. Achievement was measured by a teacher-constructed departmental final examination in geometry; attitude was pretested and post-tested by the Mathematics Attitude Inventory (MAI); enrollment was obtained from school records and by personal communication; cerebral hemisphericity reflected scores on Paul Torrance's Style of Learning and Thinking (SOLAT), Youth Form; and learning styles were categorized according to the Learning Style Inventory (LSI) developed by David Kolb.

The quasi-experimental factorial research format primarily incorporated ANOVA with two-way classification. Post hoc comparison testing utilized the Scheffe method. No interactions were noted, but significant main effects indicated that: (1) the experimental group substantially outperformed the control subjects on the second-semester final examination in geometry; (2) there was differential achievement with respect to learning style classification; (3) posttest attitude factor scores were, to some extent, dependent upon treatment group, gender, SOLAT and LSI; and (4) active-processors differed by treatment group in terms of their enrollment patterns.

## Research in Pre-K through 12 School Settings

Author: Thompson, Roger-Lee

Title: American Music: A Humanities Teaching Model for the Alternative School With Special Focus on Learning Styles

School/Degree: University of Minnesota/Ph.D.

Date: 1986

Abstract: The purpose of this project was to develop a teaching model for a humanities oriented course in American music. This model was used to teach a course in the Highview Alternative School in the District #281, Robbinsdale, Minnesota Area Schools from March 25 to May 31, 1985. The Bernice McCarthy 4MAT System was used as the pedagogical base.

The goal was to teach the eclectic nature of American music and how events of history affected the evolution of art, music and literature in the United States. Primary influences taught were English through the Pilgrims, Spanish/Mestizo through the Caribbean, and African through the slaves. These influences were traced through history and the course was concluded with students analyzing Twentieth-Century American popular music as to its musical content and historical roots.

The pedagogical basis for the course was The 4MAT System by Bernice McCarthy published in 1980. The book named four learning types called Innovative, Analytical, Common Sense and Dynamic. According to McCarthy, a person must first have a concrete experience followed by reflective observation, abstract conceptualization and active experimentation. The goal was to make learners comfortable at least twenty-five percent of the time.

The course in American music was especially appropriate for students at Highview as it offered them the opportunity to discuss and analyze “their music.” They became adept at recognizing the musical roots of current popular songs and were able to discuss and analyze “their music,” and were able to discuss the musical elements necessary to determine the style and era of a composition. The 4MAT System addressed student needs and helped them work in all learning styles. There was sufficient evidence to support the need for and acceptance of a humanities course in the alternative school.

## Research in Pre-K through 12 School Settings

Author: Ursin, Valerie Dee

Title: Effects of the 4MAT System of Instruction on Achievement, Products and Attitudes Toward Science of Ninth-Grade Students

School/Degree: The University of Connecticut

Date: 1995

Abstract: The purpose of this study was to assess the effects of the 4MAT System of Instruction on students' achievement, products and attitudes in science. The 4MAT model (McCarthy, 1987) is an organized method of instruction which recognizes students' learning or cognitive styles. The subjects were 48 students who were randomly assigned from a rural, public high school in Connecticut. The students were taught and advanced Earth Science curriculum for one semester. The experimental group was taught using the 4MAT System; the control group was taught using a textbook.

Quantitative methodology was used in this study. Data were collected and analyzed using Analysis of Covariance and Analysis of Variance to evaluate students' attitude toward science and achievement, respectively. An analysis of variance on the product scores of a valid and reliable product assessment was also performed.

The hypothesis pertaining to students' attitudes toward science was tested using Analysis of Covariance procedures. No significant differences were found, thus the null hypothesis was rejected. However, the experimental group did have positive gains in attitude on the posttest. A two-way Analysis of Variance by sex and class showed no significant differences between males and females in both groups on total attitude score. Therefore, the sub hypothesis was also not rejected.

A t-test revealed no significant differences between groups on achievement scores as measured by a criterion reference test. An Analysis of Covariance procedure showed no significant difference for the groups. Thus, the null hypothesis was not rejected. *However, post achievement means scores indicated that the experimental group scored higher on the posttest. There was a gain score increase of 9.94 points in the mean on the post-test for the experimental group females. Experimental group males had a mean score increase of 6.41 points. A t-test revealed significant differences on the achievement posttests for males and females in the experimental group.*

Analysis of Variance on the product scores for the Student Product Assessment Form for total assessment were also not significant. Therefore, the null hypothesis was not rejected.

Descriptive data tables were constructed to show the preferred learning style of the students in the control and experimental groups. Analysis indicated that 79% of the experimental group students stayed within the same preferred learning style on the posttest as they did on the pretest. The control group had 75% of the students exhibit the same preference on learning on the posttest.

## Research in Pre-K through 12 School Settings

Author: Young, Jr., Donald Blakeslee  
Title: Administrative Implications of Instructional Strategies and Student Learning Style Preferences on Science Achievement of Seventh Grade Students  
School/Degree: University of Hawaii/Ed.D.  
Year: 1986

Abstract: This study evaluated the effectiveness of an instructional model derived from the research on learning styles, science curriculum development, and the development of thinking skills that implied that a specific sequence of instructional strategies that included a discrepant event, discussion, experimentation, practice, and application would result in significantly higher achievement among students of all learning styles preferences when compared to traditional science instruction relying primarily on textbook and lecture.

Using an experimental randomized block design, seventh-grade students (125 males and 128 females) were randomly assigned to the two treatments for a total of 24 weeks. Dependent variables included student mastery of science concepts as measured by the Stanford Achievement Test; basic thinking skills as measured by the Comprehensive Test of Basic skills, (CTBS) science test; and creative thinking as measured by the Torrance Tests of Creative Thinking.

Multivariate analyses of covariance were used to examine the dependent variables with treatment, student learning style preference, and sex as independent variables, and CTBS pretest as a covariate. No significant interactions were found. Main effects of learning style and sex were not statistically significant. The main effect of treatment was statistically significant ( $p < .001$ ) affecting a linear combination of dependent variables composed of CTBS, Verbal Originality, and Figural Elaboration.

The study demonstrated that using a variety of instructional strategies in a pre-planned sequence in science significantly affects student achievement of basic thinking skills, verbal creative thinking, and figural creative concepts, regardless of sex, for students of all learning style preference, confirming McCarthy's 4MAT model of teaching hypothesis.

The study has significant implications for school administrators in the areas of staff development, curriculum development, supervision, and evaluation. Recommendations for further research include replication with other students, other grade levels, and other subject areas.

## Secondary School Additional Studies

Author: Howard, Shelley

Title: The Art of Teaching Aesthetics

Order Number: AAD13-55825

School/Degree University of Northern Colorado/M.A.

Date: 1993

Abstract: Discipline-based Art Education prescribes aesthetics in an art curriculum to ensure that students obtain knowledge and participate more fully in a complete artistic experience. The purpose of this document is to provide secondary art educators with a structure for using inquiry as a basis for the study and implementation of normative aesthetics in their curriculum. The most important feature is the incorporation of the 4MAT system developed by Dr. Bernice McCarthy as the teaching strategy for the presentation of the topic.

## Research in Pre-K through 12 School Settings

Author: Lieberman, Marcus

Title: Report on the Fairfax County Area III 4MAT Geometry Project

School: Fairfax County Public Schools, Fairfax, Va

Date: 1988

Abstract: Students taught with 4MAT showed significantly greater knowledge of middle school and high school geometry, and middle and high school science concepts than comparison groups. Students gave significantly more applications of knowledge learned than comparison groups. Students enjoyed learning the concepts more than comparison groups.

Study available from About Learning, Inc. at our Wauconda office.

## Research in Pre-K through 12 School Settings

Author: Lieberman, Marcus

Title: Report on the Fairfax County Area III 4MAT Pre-Algebra Project

School: Fairfax County Public Schools, Fairfax, VA

Date: 1988–89

Abstract: 200 pre-algebra students in an 18-week unit showed statistically significant gains from a comparison group of approximately the same number when taught with 4MAT lessons constructed by teachers who had received 4MAT training. This report is a summary of data analyses performed on measures. Study available from About Learning, Inc. Wauconda office.

## Research in Pre-K through 12 School Settings

- Author: Lisoskie, Patricia Smith
- Title: Experimental Teaching of Right and Left Hemisphere Methodology Using Biology as a Content Area (Right Hemisphere)
- School/Degree: Pacific Lutheran University/M.A.
- Date: 1989
- Abstract: A great percent of high school teaching today is through lecture, discussion, and objective testing to the left hemisphere. Research shows, however, that many students are operating at least part of the time in the right hemisphere mode when they process information. In addition to auditory processing, these students need to receive information visually and kinesthetically. This thesis discusses the history and application of right hemisphere teaching methods. The design of an experimental situation for four high school biology classes using Bernice McCarthy's 4MAT System is investigated. This system teaches to the four learning styles in both the right and left brain modes. The result of the investigation shows that students taught with The 4MAT System, when tested objectively, score an average of ten points higher than existing scores. Students subjectively rated the teaching methods better and stated that they enjoyed the subject more.

## Research in Pre-K through 12 School Settings

Author: May, Alberta Otis  
Title: The Learning Styles, Personality and Temperament Types of Eight and Twelfth-Grade Urban African-American and White Students: A Comparative Study.  
School/Degree: Seattle University/Ed.D.  
Date: 1991  
Order Number: DA9135972

Abstract: This research study sought to determine if there were differences in the learning styles, personality and temperament types of eighth- and twelfth-grade urban African American and caucasian students.

The research methodology included administering the Myers-Briggs Type Indicator (MBTI) and the Murphy-Meisgeier Type Indicator for Children (MMTIC).

One of the major findings of the study was the difference in the sensing-perception (SP) temperament between both eighth- and twelfth-grade African American and caucasian students. For example, for the eighth-grade sample SPs comprised 49.06 percent of the total eighth-grade sample, 100 percent of eighth-grade African American males, 70.59 percent of eighth-grade African American females, 30.77 percent of eighth-grade caucasian males, and 50.00 percent of eighth-grade caucasian females. Conversely, for the twelfth grade sample SPs comprised 25.19 percent of the total twelfth-grade sample, 50 percent of twelfth-grade African American males, 21.95 percent of twelfth-grade African American females, 21.95 percent of twelfth-grade caucasian males, and 22.86 percent of twelfth-grade caucasian females. Statistically significant differences were also found in the SJ and NT temperaments for both the African American and caucasian samples.

The findings from this study lend support to other research on learning styles, personality and temperament types and reaffirms the need for additional research in this area in relation to academic achievement. [253 pages]

## Research in Pre-K through 12 School Settings

- Author: McCoun, Paula and Kay Criswell
- Title: Gender Differences in Attitudes, Spatial Visualization Ability, and Learning Styles of Remedial Mathematics Students (Mathematics Attitudes)
- School/Degree: Texas Tech University/Ed.D
- Date: 1993
- Order Number: ADG93-25778. 9311.
- Abstract: A study involving 90 students enrolled in four sections of a remedial mathematics course was conducted to determine if gender differences in the non-remedial and general population also appeared in the remedial mathematics population. Students were administered three instruments: an attitudes survey consisting of four scales of the Fennema-Sherman Mathematics Attitudes Scales, the Differential Aptitudes Test (DAT), Space Relations Subtest, and Kolb's Learning Style Inventory (LSI).
- Two significant gender differences were found: males scored significantly higher on the DAT Space Relations Subtest, and females scored significantly higher on the Reflective Observation mode of Kolb's LSI.
- The suggestion was made that remedial mathematics teachers work to increase students' spatial skills and decrease their dependence on the Reflective Observation mode. [132 pages]

## Research in Pre-K through 12 School Settings

Author: Monroe, Mark S.

Title: An Analysis of High School Seniors' Learning Styles as They Relate to Student Achievement and Attrition in the Science Curriculum.

School/Degree: Memphis State University/Ed.D.

Date: 1992

Order Number: ADG92-24283. 9210.

Abstract: Researchers have noticed that students avoid the disciplines of the sciences, both life and physical sciences. This study was designed to ascertain if a relationship existed between science curriculum achievement/choices and the student's preferred learning style. The study addressed two specific relationships. One was the relationship between learning style and achievement in science as measured by scores on the natural science section of the ACT and by the student's cumulative high school science GPA. Also, focus was given to the relationship between the student's learning style and the number of acquired science semester credits. Results from statistical analyses indicated that several learning style groups differed significantly when comparing scores on the natural science section of the ACT. The accommodator group had significantly lower scores than those of the converger group or those of the assimilator group. The same two pairs, accommodator-assimilator and accommodator-converger, had significantly differing means of the number of science credits acquired. Results of the ANOVA did not indicate a significant relationship between the seniors' learning style and their cumulative high school science GPA. Implications for Teacher Education were addressed. Specifically, a continued awareness of learning style theory was felt warranted because students perceive and process information uniquely, applying a specific configuration of tactical problem-solving techniques. Some students, such as those with an accommodator learning style profile were not as science orientated. The use of a deductive instructional approach, as well as the more traditional inductive methodology, was suggested to assist the accommodator group, characteristically deductive learners. Recommendations for further research were listed. [87 pages]



## Dissertations: Professional Development

Author: Caldwell, Dorothy Ann  
Title: Staff Development Process that Results in Change: A Training of Trainers Cadre  
School/Degree: The University of Oklahoma/Ph.D.  
Date: 1997  
Abstract: The literature is inundated with information regarding school improvement and staff development, and yet, few schools are implementing changes as a result of these processes. This qualitative study examined a training of trainers Cadre during and after training in the schools and classrooms of seven participants.

Each Cadre included three phases. Phase I focused on adult learning, research-based staff development, learning styles, group processing, and effective presentation skills. For the learning styles component, Bernice McCarthy's (1987) was selected because McCarthy's 4MAT System connects the knowledge of differences in the way people learn to lesson plans for teaching. Phase II dealt with assessment as a content area, and Phase III integrated Phase I and Phase II and provided follow-up strategies for implementation.

Two research questions guided this study. The first one was concerned with the nature of implementation of the assessment concepts. The second question focused on the factors that facilitate, impede, and modify the implementation process. Changes that occurred as a result of the Cadre were the physical environments of the classroom, expansion of instructional strategies, student evaluation, and the teachers' confidence. Overwhelmingly, teachers felt they were better teachers. They understood the differences in learners, how to plan for interaction more clearly, and the need to provide a variety of choices and assessments to meet all students' needs.

Findings that facilitate the implementation process were: (1) provide time for professional development; (2) ensure district and principal support; (3) establish follow up and maintenance procedures; (4) designate someone to be held accountable at all levels; (5) establish an environment conducive to change; (6) connect new information to present teaching; (7) create a core of teacher leaders; (8) share ideas through dialogue and reflection; and, (9) have a belief in what you are doing.

The factors that impede the implementation process are: (1) failing to provide time for professional development; (2) omitting follow-up and maintenance and, (3) change itself.

The one factor that modified implementation was being able to modify the concepts from the Cadre training to personal and site needs.

The implications and recommendations integrate previous learning with new findings. A new model is provided for a structure to ensure implementation of staff development. This model provides the image of how to impact change.

The training of trainers program provides an answer to staff development that is a continuous job-embedded process. It provides the flexibility and adaptability for our rapidly changing society to meet the demands on public education.

## Research in Post-Secondary Settings

Author: Craig, Allan J.

Title: Principals as Intrapreneurs: An Examination of the Management of Instructional/Curriculum Implementation in Secondary Schools

School/Degree: University of Toronto/Ed.D.

Date: 1991

Abstract: This study examined the role of the secondary school in managing the implementation of the 4MAT System, an instructional / curriculum innovation designed to improve teaching methodology in the classroom. The study was based upon the assumption that knowledge of the way principals and teachers think about the role of the principal in managing change could increase our understanding of this role and make a contribution to theory and practice.

The study was conducted in three secondary schools of a large urban school board. Data were collected to determine: What influenced the principal's decision to initiate the implementation of the innovation. What knowledge and skills do principals perceive as being most critical to manage the implementation of the innovation. What factors affected implementation, and which factors did the principals try to address. What strategies did the principals use in managing the implementation of the innovation. And, what was the effect of the principals' effort on teachers.

It was clear from the results of this study that principals can influence teacher implementation by addressing factors that affect implementation. Equally important in this view of the intrapreneurial (internal entrepreneur) principal was the identification of a core set of strategies / activities that were reported by teachers to be very helpful to their implementation of the 4MAT System.

In summary, this study provides evidence that capable principals can initiate and manage meaningful curriculum/instructional change.

## Research in Post-Secondary Settings

Author: Griffin, Maureen L.  
Title: A Case Study of Transfer of Learning Activities in a Trainer of Trainers Program  
School/Degree: University of Wisconsin- Madison/Ph.D.  
Date: 1997

Abstract: One form of staff development used in the field of education is called trainer of trainers and has infrequently been the focus of research efforts. The trainer of trainers model (ToT) is a two (or more) tiered design for disseminating information and skills. The design of a ToT assumes that selected individuals from a school district will receive training from experts for the purpose of training large numbers of others in their school district who cannot be trained by the experts.

The purpose of this study was to describe and analyze how one trainer of trainers' program attempted to achieve its goals. The following objectives were established: (a) to describe and analyze one trainer of trainers program's activities carried out before, during, and after training by both the ToT program and participating school districts; (b) to identify activities that support and impede the ToT program's goals; and (c) to describe the experiences of ToT participants.

A specific ToT program, the 4MAT System from About Learning, Inc., was studied. Activities were identified across phases of the program (before, during and after) and across stakeholders (ToT participants, ToT program, and school districts). Participant observation and interviews were the methods used to collect data. This study revealed that shared responsibility for transfer of learning activities by school districts, the ToT program, and the ToT participants is essential. In addition, four factors were uncovered which appear to be critical levers for the success of a ToT program: (a) the selection process (of suitable participants, of a relevant and quality ToT program, of a receptive and primed setting); (b) the preparation of ToT trainees for their new roles (trainer, coach, change agent); (c) formation of learning teams (during the ToT program and back in the team's school); and (d) the inclusion of evaluation in planning for implementation of a ToT program. If educational agencies continue to use this staff development model, the above factors must seriously be considered in the design and selection of ToT programs and continued research on the model is recommended.

## Research in Post-Secondary Settings

Author: Klenetsky, Phyllis Schiffer  
Title: The Impact of 4MAT Training on Teachers' Attitudes Towards Student Behaviors Associated with Creativity  
School/Degree: Florida Atlantic University/Doctor of Education  
Date: 1997

Abstract: The purpose of this study was to determine if 4MAT training had an impact on teachers' attitudes towards students' behaviors associated with creativity. Specifically, this study analyzed the relationship between the dependent variable of attitude toward creativity, and the independent variables of levels of training, grade level, years of teaching experience, and subject area.

A sample of 459 subjects consisted of an experimental (n=310) and control group (n=149). The experimental group received either Fundamental 4MAT training or both Fundamental and Intermediate training, while the control group received no intervention. The Ideal Child Checklist (ICC), developed by Torrance, 1975), was used as a pre- and posttest measure to determine change in attitude following treatment.

Responses on the ICC were tallied to create a single score on the instrument. Statistical methods used to analyze the data consisted of (a) a t-test to compare 4MAT with controls by calculating the difference between pre- and posttest scores, (b) a one-way analysis of covariance to compare level of training, and (c) a two-way analysis of covariance to compare levels of training with independent demographic variables.

Five hypotheses were developed to determine if 4MAT training had an impact on attitudes and the aforementioned variables. All hypotheses were tested at the .05 level of significance.

Based on the findings of this study, none of the demographic variables had a significant relationship to change in attitude towards creativity, beyond what could normally be expected by chance. However, the 4MAT group had a statistically significant higher attitude score than the control group,  $t(147)=6.29$ ,  $p<.001$ , and there was a statistically significant difference between groups for control and levels of training,  $F(2, 307)=35.46$ ,  $p<.001$ .

## Research in Post-Secondary Settings

Author: Medford, Lienne Federico  
Title: A Curriculum Development Response to the North Carolina Professional Practices Commission's Call for Cultural Diversity  
School/Degree: East Carolina University/Ed.D.  
Year: 1996

Abstract: The purpose of this dissertation is to provide a curriculum development response to the North Carolina Professional Practices Commission's report "A Time for Understanding and Action: Preparing Teachers for Cultural Diversity." The two middle school multicultural enrichment units provided by the dissertation seek to fulfill the Commission's two criteria: adding multicultural material to the standard curriculum and presenting the material in ways responsive to a variety of learning styles. The topics of the units are African-American folktales and African-American holidays.

A pilot test of the African-American folktale unit was conducted at Myrtle Grove Middle School in Wilmington, North Carolina, in the spring of 1995. The unit was also reviewed by a panel of North Carolina teachers and administrators who were participants in the 1995 East Carolina University Institute of Multicultural Education and Change. The data from these two studies supplied additional information for the designing of the African-American holidays unit. Both units were designed to follow Bernice McCarthy's 4MAT method.

The dissertation examines the pertinent literature in the areas of multicultural education's trends and critics, multicultural curriculum development models, and primary and secondary sources in the areas of African-American folktales and holidays.

The design and methodology section of the dissertation traces the set up and implementation of the pilot study, and it examines the qualitative data generated by student essays and instructor opinions of the study. The results and discussion portion of the dissertation examines the quantitative data generated by the East Carolina Institute of Multicultural Education and Change panel.

The final section of the dissertation discusses the changes that the study suggests and implications for further research. The study's conclusions express a desire for a change in university pre-service preparation of teachers. This change should incorporate a stronger emphasis on familiarity with diverse learning styles and an ability to present material in a way that will appeal to a wide variety of students. In addition, undergraduates should be familiarized with a wider spectrum of multicultural ideas and sources, because in-service teachers have little time to spend searching for new instructional materials.

## Research in Post-Secondary Settings

Author: Miller, Jane

Title: Transferring Teaching Skills and Strategies from the Inservice Workshop into Practice in the Classroom: An Evaluation of One District's Experience

School/Degree: State University of New York at Buffalo/Ed.D.

Date: 1989

Abstract: The purpose of the study was to explore the degree to which teachers learned and transferred teaching skills and strategies from the workshop into practice in their classroom. The intervention studied was the 4MAT teaching model. The research investigated this question by collecting and analyzing data on: (1) attitude toward The 4MAT System, as measured by a self-report questionnaire; (2) knowledge about the system, as measured by an objective test; and (3) use of the system in the classroom, as measured by the number and quality of 4MAT lesson plans teachers developed.

The population consisted of 353 K–12 teachers. The four treatment groups included: Untrained Group—teachers receiving no training in The 4MAT System; Awareness Group—teachers receiving only initial training; Lesson Planning Group—teachers attending follow-up training emphasizing 4MAT lesson design; and Support Group—teachers attending support group meetings following training.

The hypotheses tested were the following: the greater the degree of exposure to the system, the more likely the teachers would be (1) to express positive attitudes toward 4MAT, (2) to know the facts and operating principles of 4MAT, and (3) to use 4MAT in planning actual lessons.

The results of the Questionnaire, Knowledge Survey, and lesson plan analysis supported all three hypotheses. On the Questionnaire, a Friedman Two-Way Analysis of Variance by Ranks yielded a .001 level of significance, indicating that the increasingly positive attitude that occurred is likely a result of continued exposure to The 4MAT System rather than a result of selection. The twenty-five item objective test revealed a definite progression of knowledge with means of 3.4, 8.6, 16.2, and 22.5 for the Untrained, Awareness, Lesson Planning, and Support Groups, respectively. A One-Way ANOVA on these results yielded a .001 level of significance. Lesson plans critiqued by two independent raters using the Lesson Plan Criterion Scale ranged (after scores were averaged) between 1 and 2.2 (1—Well Done, 2—Sufficiently Done, 3—Partially Accomplished, 4—Not Accomplished) indicating that these teachers had transferred the skills from the workshop into their actual lesson plans. Implications including providing follow-up training and support groups as opposed to “one-shot” workshops are discussed.

## Research in Post-Secondary Settings

Author: Montgomery, Paula Monette Singleton  
Title: The Effectiveness of the 4MAT Multi-Level Staff Development and Teaching Model in a Selected School District  
School/Degree: University of Southern Mississippi  
Date: 1997

Abstract: The primary purpose of this study was to explore the relationship between teachers' attitudes toward a multi-level staff development, their knowledge of program components, and their level of use of the program. Additionally, the subjects' teaching experience and grade levels taught were also important to this study. In particular, the study investigated the 4MAT teaching model as introduced during staff development training in a southwestern rural school district. The research addressed this question by collecting and analyzing data about: (1) teachers' attitudes toward the 4MAT teaching model, as measured by a questionnaire; (2) knowledge about the system, as measured by a survey and (3) use of the 4MAT teaching model in the classroom, as measured by prescribed criteria to evaluate lesson plans. The ultimate goal of this study is to provide data concerning the feasibility and effectiveness of the 4MAT multi-level staff development to the 4MAT Corporation and the administration of the selected school district.

The study provided a review of the literature related to attitudes toward staff development and the process of the transfer of skills from staff development training to classroom use

The subjects of this study were 1997 educators in a selected southwestern Louisiana school district. Nine-hundred and fifty-four Questionnaire and Knowledge Surveys were provided to be administered to the teachers of the entire district. Administration of the instrument was conducted by the building administrator on the target date. A total of 569 were returned. In addition to responding to the 4MAT Questionnaire and Knowledge Survey, teachers were also asked to provide educational demographic information pertaining to sex, level of 4MAT training, grade level taught and years of teaching experience. Teachers were also asked to volunteer a 4MAT lesson plan for evaluation by an independent rated. The lesson plans were assessed using a prescribed criteria that is based on the teaching strategies presented during the 4MAT staff development.

The analysis of data pertaining to the testing of the hypotheses is presented. There was a significant relationship between teachers' attitudes toward a multi-level staff development program, their knowledge of program components, their level of use, their grade level taught and their teaching experience. No significant relationships were found when interactions were addressed.

This dissertation presents a discussion related to the results of the study. In consideration of the study's findings, recommendations for future research are included.

## Research in Post-Secondary Settings

- Author: Morley, Jamie Ann
- Title: The Effect of the 4MAT System of Instruction on Achievement in Students Completing Computer Certification Courses through Distance Education
- School/Degree: Capella University, Ph.D.
- Date: 2000
- Abstract: The primary purpose of this study was to determine whether students enrolled in the computer Repair Technician course at Trinity Learning Solutions and taught through distance education using the 4MAT system of Instruction would have higher test scores than students taught using Trinity's original distance learning curriculum. The dependent variable in this study was the student test scores. The independent variables were learning style and curriculum design version. Other topics investigated in this study were which learning type, if any, performed higher in Trinity's mentored distance learning methodology and whether or not being taught by an instructor with a matching learning type had an effect on the students' mean test scores. The instruments used in this study were McCarthy's (1987) Learning Type Measure and Trinity's assessment exams, which were written by Course Technology, Inc. Test scores obtained from students taught using the original curriculum were compared with test scores from students taught using the 4MAT instructional design method. Descriptive and inferential statistics including ANOVA, chi-square, and the student t-test were used to analyze the data. Study findings indicate that the first null hypothesis was not rejected at the  $p > .05$  significance level but that it was rejected at a  $p > .09$  level. These findings suggest that there were mean test score increases among some of the learning types but not enough to reject at the  $p > .05$  level. The second and third hypotheses were both rejected at the  $p > .05$  level. Analysis of the findings revealed that Type 3 learners performed significantly better than learners from the other three quadrants. The findings also suggested that students taught by an instructor with a matching learning profile perform significantly better than students taught by an instructor with a mismatching profile. These findings support other similar research.

## Research in Post-Secondary Settings

Author: Murray, Anna M.

Title: Training Teachers to Foster Creativity Using The 4MAT Model

School/Degree: University of Massachusetts/Ed.D.

Date: 1992

Abstract: This study was undertaken to assess outcomes of a teacher training program whose goal was application of the 4MAT Learning Style Model (McCarthy, 1981) to the design of lessons which foster student creativity. Results derived from the analysis of data in this study indicate that the training program met its objectives of content mastery, attitudinal change, and application of theory, within the context of a case study involving 27 subjects undergoing 36 hours of training.

Goals of the training program included: (1) developing understanding of basic learning style and creativity concepts; (2) increasing positive attitudes regarding the significance of diversity and creativity; and (3) applying concepts taught through construction of 4MAT lesson plans.

Results indicate that (1) during the course of the training there was a significant increase in positive attitude regarding the importance of accommodating diversity and creativity in educational settings; (2) that the training program prepared the majority of participants to develop lessons which integrated creativity and learning style theory, while satisfying 4MAT criteria; (3) that performance on lesson plan design correlated more closely to attitude than to content; and (4) that gender and learning style of participants appeared to significantly affect assessment scores.

Some Conclusions: (1) The 4MAT Model is philosophically, theoretically, and structurally suited to the development of creativity. (2) Creativity can be defined and incorporated into classroom instruction. (3) A 36 hour training program can sufficiently prepare teachers to apply learning style and creativity research to the design of a 4MAT lesson. (4) Patterns of participant performance in training situations may be influenced by gender, learning style, and grade level taught. (5) Personal involvement of the learner is a key element of understanding diversity and creativity. (6) A Retrospective Attitude Survey provides useful information regarding attitudinal change during the course of a training program. (7) Content mastery, application, and attitudinal change are key components of training which should be planned for, implemented and assessed.

## Research in Post-Secondary Settings

Author: Ojure, Lenna  
Title: An Investigation of the Relationship Between Teachers' Participation in 4MAT Fundamental Training and Teachers' Perception of Teacher Efficacy  
School/Degree: Virginia Tech University/Ph.D.

Abstract: The relationship between teachers' participation in learning style training and their perception of teacher efficacy was investigated three ways. Teachers who participated in 4MAT training were surveyed, observed and interviewed. The Gusky and Passaro (1994) teacher efficacy scale was given to 120 K-12 teachers at 4MAT training sites. The survey was administered three times: before the workshop, immediately after the workshop, and one month after the teachers had returned to their classrooms. The scale measured two teacher efficacy factors: (a) internal teacher efficacy- perceptions of personal influence and impact on teaching and learning situations; (b) external teacher efficacy- perception of the influence and impact of elements that lie outside the classroom on teaching and learning situations. In addition, teachers at one learning style training site were observed to determine how readily they adapted learning style technology. Finally, six teachers were interviewed three times each to determine if factors found by Ashton (1984) to be associated with high level of teacher efficacy were present.

Perceptions of internal teacher efficacy increased significantly from pre to post workshop administrations. After the teachers had been in the classroom for one month, internal teacher efficacy scores were lower than immediately after the workshop but still significantly higher than before the workshop. The training had no significant impact on external teacher efficacy scores. An interaction was found between teachers' level of previous knowledge and the reported gain in internal teacher efficacy. Those teachers with little previous knowledge of learning style theory and methodology showed higher levels of gain in internal teacher efficacy immediately after the workshop and on the one-month follow up survey.

The teacher' discourse during interviews and behavior during the workshops reflected all the elements Ashton outlined as associated with teacher efficacy: a belief in students' potential to learn and develop, awareness of the classroom as a social setting, and use of reflective behavior. These data also suggested that the maintenance of a high level of efficacy was influenced by the support of colleagues, modeling of instructional techniques, and validation of teachers' ideas concerning practice. It was also noted that teachers adapted 4MAT methodology idiosyncratically.

These findings suggest that knowledge of learning style theory and practice can be valuable to teachers. It appears that examining the impact of learning style training on teachers' attitudes and behaviors may provide meaningful insights into why learning style concepts continue despite an inconclusive research base.

## Research in Post-Secondary Settings

Author: Spatz, Thea Siria  
Title: A Comparison of Two Programs for Teaching Breast Self-Examination to Women  
School/Degree: University of Arkansas/Ed.D.  
Date: 1987

Abstract: Middle-aged and elderly female members of Home Demonstration clubs participated in a study that compared two methods of teaching breast self-examination (BSE) to a control group. The 4MAT presentation (N = 63) addressed four learning styles and brain dominance functions. The American Cancer Society (ACS) presentation (N = 53) used a traditional lecture/discussion format. The Control group (N = 63) attended a club presentation unrelated to cancer or BSE. The materials and information used in the two BSE presentations were the same; the method of presentation differed.

Five dependent variables were measured: knowledge of breast cancer and BSE, regularity of practice of BSE, confidence in performing BSE, belief in the importance of BSE, and intent to practice BSE. These variables were measured before training (pretest), after training (posttest), and three months later (follow-up). The data was analyzed so learning (posttest minus pretest) and retention (follow-up minus pretest) were assessed.

The method of presentation made a difference. For nine of the ten comparisons of the three groups (four to assess the effects on learning and five to assess the effects on retention), the means improvement scores were ordered as 4MAT, ACS, and Control. A tenth comparison of the three groups was not expected to show any ordering.

ANOVA's and Scheffe tests showed that the 4MAT group was significantly better than the ACS group in knowledge, both in learning and in retention. The 4MAT group was significantly better than the Control group in knowledge (learning and retention), practice (retention), confidence (learning and retention), belief (learning), and intent (learning). The ACS group was significantly better than the Control group in knowledge (learning and retention), confidence (learning and retention) and intent (learning).

The method of presentation had a sizable effect on what was learned and retained. For older learners in settings other than traditional academic ones, a presentation that addresses different learning styles and left and right brain functions is recommended.

## Dissertations: Adult Education

Author: Buchanan, Linda Kay  
Title: A Comparative Study of Learning Styles and Math Attitudes of Remedial and College-Level Math Students.  
School/Degree: Texas Tech University/Ed.D.  
Date: 1992  
Order Number: ADG92-26325. 9210.

Abstract: At this time, there are seven states that are practicing mandatory testing and placement in mathematics.

However, the literature reveals that no “cure-all” has been found. In spite of the variety of modes and methods being used, no one has produced results so remarkable for a consensus to develop. The purpose of this study was to explore differences between remedial and college-level math students in an effort to discover characteristics of the remedial population that might lead to more effective educational practices.

The remedial students were significantly more concrete in their learning style while the college-level students were more abstract. A significant relationship was found between learning styles and math attitudes for both groups, but was more pronounced in the remedial group. The diverger learning style was related to lack of success in the combined groups of students. A significant relationship appeared between math attitudes at the end of the semester and final course grades for both groups of students. Further studies are suggested to explore the significance of responding to these affective and scholastic characteristics in the remedial classroom. [127 pages]

## Research in Post-Secondary Settings

Author: Cordell, Barbara Jean

Title: The Effects of Different Learning Styles Outcomes of Education  
Using Two Computer-Assisted Instructional Designs

School/Degree: The University of Utah/Ph.D.

Date: 1989

Abstract: The use of Computer-Assisted Instruction (CAI) in the health field is rapidly increasing. Several strategies, or instructional designs, are available in CAI and little information exists to assist in deciding which strategy to use. One dimension in education that would help educators decide which strategy to use is learning style. This study's aim was to determine whether or not learning styles as assessed by the "4MAT" Learning Styles Inventory affect the outcome of learning with two CAI design strategies: linear and branching.

A multiple classification experimental design was used. Two variables, one independent (instructional design) and one moderator (learning styles), were considered. The dependent variable was learning outcome as measured by the scores on a posttest.

All tested subjects (200) completed the learning styles inventory. The inventory was scored and learning style determined. The subject was then randomly assigned to either the linear or branching health tutorial. The number of correct and incorrect responses on the posttest was kept by the computer. A Likert-type opinionnaire was then administered to see if subjects enjoyed the CAI design and developed positive attitudes toward CAI.

A two-way analysis of variance was performed on the data. The results showed significant main effects for instructional design, no main effects for learning style and no effects for interaction of instructional design and learning style. Even though there was no statistically significant interaction effect, there was an educationally significant curvilinear interaction. This interaction was further supported by the opinionnaire data.

## Research in Post-Secondary Settings

Author: Crawford, Cynthia E  
Title: The Internet Master Program: Internet Education for Adults and Facilitating Volunteer Community Education  
School/Degree: University of Missouri-Columbia/Ph.D.  
Date: 1997

Abstract: The primary purpose of this study was to examine characteristics of those participating in the pilot classes of Internet Masters, the training approach of the Internet master program, and the impact of volunteer community education on participants.

A repeated measures design was utilized for the study. The repeated measures instruments were administered at the beginning of class one, at the conclusion of class 10, and when the Internet master concluded volunteer community education. An additional measure was the Learning Type Measure administered during the ninth lesson of each series. Descriptive statistics were first established. A general linear model repeated measure analysis of variance (ANOVA) design was utilized for hypotheses testing.

The Internet Master programming attracted adults of all ages with a wide variety of educational backgrounds that were highly motivated to learn about the Internet. Internet masters median use of the Internet quadrupled from a median of 2 hours per week prior to classes to 10 hours per week during classes. Internet Masters projected they would remain at a median of 10 hours per week after classes concluded.

Eighty-five percent of those enrolled in the Internet master program completed the instructional curriculum. Of the two classes that had completion deadlines prior to the on conclusion of the data collection process for this study, there was a less than 50% successful volunteer community education completion rate. The curriculum was successful in precipitating statistically significant increases in knowledge and use of the Internet and confidence to facilitate community education from the beginning of class 1 to the conclusion of class 10.

There was not a statistically significant difference between the variables Learning Type Measure, watching/doing scores, gender, age, education, and year home computer was first purchased and repeated measures of knowledge and use of the Internet or facilitating community education from the beginning of class1 to the conclusion of class 10 or repeated measures from the conclusion of class 10 to the conclusion of volunteer community education.

## Research in Post-Secondary Settings

Author: Handley, Cynthia  
Title: Clinical Laboratory Science University Faculty Learning Types and the Use of Information Technology in the Classroom

School/Degree: Louisiana State University/Ph.D.

Date: 1998

**Abstract** This study was designed to explore the status of learning types of clinical laboratory science university faculty and their use of information technology in the classroom. Traditionally laboratory science education has been lecture and lab sessions. However, with the advent of the information age, professors are moving from the role of lecturer to facilitator. Some professors are in tune with the new information tools, while others are not interested at all.

This research had a two-fold purpose: 1) to explore who was using technology in the classroom and identify what they were using, and 2) to search for a possible relationship between a professor's learning type and the use of information technology in the classroom. To meet these ends, the researcher chose to conduct a national survey of university-based clinical laboratory science professors. A national list of faculty was compiled and a random sample was chosen. This study employed a commercial learning type tool (McCarthy's Learning Type Measure) and a self-designed information technology use instrument.

Data received from the survey were analyzed using the statistical package SPSS. Descriptive statistics were performed using the demographic variables, learning types, and information technology use scores. Two one-way analyses of variance were performed, one with technology scores and the highest preferred learning type quadrant and one with the technology scores and the lowest preferred learning type quadrant. A significant difference was found between the technology scores and the highest preferred learning type quadrant. A Tukey's analysis indicated a significant difference between the use of information technology for quadrant three learners and quadrant two learners. A multiple linear regression was run with the technology score as the dependent variable and the learning type quadrant and demographics as the independent variables. Seventeen percent of variance in the technology scores was explained by the independent variables which were loaded into the regression equation.

This research indicated that there was a relationship between the respondent professors' learning type and their use of information technology in the classroom. Although this cannot be generalized to the population, the researcher would recommend this topic for further study.

## Research in Post-Secondary Settings

Author: Hearron, Mary Carol

Title: The Predictive Effect of Logical Thinking, Prior Knowledge, and Learning Style Characteristics on Academic Achievement in an Anatomy and Physiology Course.

School/Degree: East Texas State University/Ed.D.

Date: 1991

Order Number: DA9214344

Abstract: *Purpose of the study.* The major purpose of this study was to identify the combined predictive effect of logical thinking, prior knowledge, learning style characteristics, and various demographic variables on academic achievement in an anatomy and physiology course in which selected community college students were enrolled.

*Findings.* The major findings of this investigation included the following: (1) The variables of logical thinking, age, prior knowledge, prior college-level general biology course, and the learning style of abstract conceptualization produced a statistically significant predictive model,  $F(5,287) = 30.50$ ,  $p < .00005$ , for academic achievement in an anatomy and physiology course. (2) The best predictive models were produced for three specific sub-groups within the population including (a) those subjects who enrolled in an anatomy and physiology course following a prior college-level course in general biology, (b) those subjects who were LVN's and (c) those subjects who were G.E.D. graduates. (3) A statistically significant difference ( $p < .00005$ ) in academic achievement was found between those subjects who had completed a prior college-level general biology course and those who had not, as well as between those subjects who were classified as concrete operational and those who were classified as transitional or formal operational.

*Conclusions.* This study provided evidence for a statistically significant relationship between logical thinking ( $r = .4653$ ,  $p < .001$ ), prior knowledge ( $r = .2966$ ,  $p < .001$ ), and abstract conceptualization ( $r = .1824$ ,  $p < .01$ ) and academic achievement in an anatomy and physiology course. Additionally, all three variables combined to produce a statistically significant predictive model for academic achievement. [144 pages]

## Research in Post-Secondary Settings

Author: Wedeking, Lorene A.

Title: The Learning Styles of Public Health Nurses

School/Degree: Capella University, Ph.D.

Date: 2000

Abstract: The purpose of this study was to identify the learning styles of practicing public health nurses. An answer to this question has taken on greater importance as more and more of the continuing education and training for the public health workforce, including that of nurses, is done through distance education. The Learning Type Measure was used to assess the learning styles and Watching/Doing preferences of 106 public health nurses practicing in the upper Midwest states of Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin. This group was slightly younger than the average age for public health nurses in the United States and was slightly more female than the national average for registered nurses. The racial and ethnic background of the research participants mirrored that of registered nurses in the North central states. About 72% of the group held baccalaureate degrees in nursing. Type 1 Learning Style was selected by 44%, Type 2 Learning Style by 17%, Type 3 learning Style by 19%, and type 4 Learning Style by 12% of the group. A small part of the group, 7.4%, did not make a single type selection; they opted for tie scores for two or more learning style types. The group was about evenly divided between Watching and Doing as an information-processing strategy, with 53% of the group selecting Doing. Age, educational attainment, and experiences as a public health nurse were not statistically significant factors in nurses' selection of learning style. Experience as a registered nurse, however, was statistically significant. Recommendations are given for suggested actions in the design of continuing education for public health nurses and for health education for clients. Recommendations are also given for additional research studies.

## Additional Studies: Professional Development

- Author: Cox, Charlotte; And Others
- Title: Balancing Innovation and Tradition to Create Learning Opportunities for All Learners.
- Publication: In Walking the Tightrope: the Balance between Innovation and Leadership. Proceedings of the Annual International Conference of the Chair Academy (6th, Reno, NV, February 12-15, 1997). ED407005
- Description: In an effort to improve instruction and give greater attention to teaching techniques that accommodate different learning styles, Nevada's Truckee Meadows Community College (TMCC) implemented the 4MAT System Fundamental Training for faculty. The 4MAT System identifies four major learning styles (i. e., learners who are primarily interested in personal meaning, those interested in facts, those interested in how things work, and those interested in self-discovery) and recommends that learners be taught in all four styles. As a result of the 4MAT training, the college has witnessed increased networking among faculty, while faculty report a newfound enthusiasm for teaching and successes with students. There are also certified 4MAT system trainers on campus, allowing the college to offer the techniques to staff and community members indefinitely.

## Research in Post-Secondary Settings

Author: Irish, Barbara Moffett

Title: Meaning in Music: Cognitive and Affective Response in Adults (Cognition)

School/Degree: Cornell University/Ph.D.

Date: 1993

Order Number: ADG93-25293. 9310.

Abstract: Important epistemological questions concerning the meaning of music are relevant to the place of music in a society and the educational life of its people.

Correlation of preferred learning styles and listening to music response was high, and the relationship of adults' vocational or avocational interest in music and cognitive/affective response was confirmed. [270 pages]

## Research in Post-Secondary Settings

- Author: Lieberman, Marcus
- Title: Report on the Fairfax County Area III 4MAT Project
- School: Fairfax County Public Schools, Fairfax, VA
- Date: 1986–87
- Abstract: This report is a summary of data analyses performed on measures administered to 91 4MAT participant teachers early and late in the 1986–87 school year. The measures included awareness of the four learning styles and the left/right hemispheric modalities included in The 4MAT Model. Attitudes consistent with the 4MAT philosophy were assessed with a questionnaire. Knowledge of the eight steps of the lesson plan was measured with an eight question matching exercise. The final measure was a pair of actual lesson plans, one constructed early in the 4MAT training sequence and one constructed late in the year. Teachers who had an opportunity to test out a lesson plan responded to a reaction sheet and the responses are summarized along with their general perceptions of the strengths and weaknesses of 4MAT. This information provides a complete picture of the teacher-focused phase of this project. Available from About Learning, Inc. at our Wauconda office.

## Research in Post-Secondary Settings

Author: Reed, Philip Anthony

Title: The Relationship Between Learning Style and Conventional or Modular Laboratory Preference Among Technology Education Teachers in Virginia

School/Degree: Virginia Polytechnic Institute and State University/Ph.D.

Date: 2000

Abstract: This study investigated the relationship between the laboratory environments and the learning styles of middle school technology education teachers in the Commonwealth of Virginia. Based on the assumption that a strong relationship between teaching and learning styles exists, it was hypothesized that teacher preference for one type of laboratory over another (conventional or modular) may be an issue of learning style.

A random sample (n=195) was drawn from the entire population (as identified by the Virginia Department of Education in 1998) of public middle school technology education teachers (N=392). Randomly selected teachers were mailed a cover letter, demographic questionnaire, postage-paid envelope, the Learning Type Measure (LTM) instrument, and one dollar for taking the time to complete and return the instrument. The LTM instrument, demographic questionnaire and Bernice McCarthy's research on the 4MAT System of Leadership and Instruction were used to describe the laboratory environments and the teaching and learning styles of the respondents. Data collected were compared using contingency tables and Pearson's Chi-square analysis.

Eighty-three (42.5%) of the middle school teachers responded and sixty-five of the instruments (78%) were usable. The findings indicate that respondents were overwhelmingly male (94%) and had considerable teaching experience ( $x = 17.4$ ). Sixty-six percent of respondents taught in a modular laboratory and forty-percent taught in a conventional laboratory. Of the four learning styles identified by the LTM (Imaginative, Analytic, Common Sense, and Dynamic), respondents overwhelmingly (69.2%) rated themselves as Common Sense learners. Common Sense learners as teachers encouraged practical applications, are interested in productivity and competence, like technical things, use hands-on activities, and try to give students the skills they will need to be economically independent in life. These findings are consistent with previous research involving the personalities and learning styles of industrial arts/technology educators.

The self-perceived learning styles of respondents were significantly different when compared to McCarthy's findings for secondary teachers and administrators in general. However, the learning styles of respondents in conventional laboratories were not significantly different than the learning styles of respondents in modular laboratories. Though it seems logical that learning style might explain laboratory preference, this notion was not supported by this study.

## Research in Post-Secondary Settings

Author: Scott, Harry V.

Title: A Serious Look at the 4MAT Model

School/Degree Literature Review/ED383654

Date: 1994

Abstract: 4MAT, an eight step model developed by Bernice McCarthy, is derived by interacting each of Kolb's four quadrants with both left and right brain teaching strategies. McCarthy concluded that the full cycle of a lesson would include eight activities, accommodating each of Kolb's four types of learners using both right and left techniques in each quadrant. Such lessons highlight the style of each learner for some fraction of the whole and rotation between left and right gives prime time to the basically different orientation and should lead to whole-brain performance. This paper is a review of professional literature on research with 4MAT as a tool for instructional design and staff development as well as a theory, its use and implication validity and legitimization. There is no direct criticism of the 4MAT model in the literature, though some educators have questioned the relevance of the concept of learning styles to instructional design. Legitimization of the model has come through academic discussion and widespread use of 4MAT concepts. Review of the literature on 4MAT has revealed little research of student achievement. The professional literature indicates that the 4MAT model is capable of comprehensive use, for developing instructional units for discursive as well as non-discursive disciplines, for secondary as well as elementary education, and for urban as well as suburban schools.

## Additional Studies: Adult Education

- Author: Lust, Carol and Ann White
- Title: The Influence of Preferred Learning Style on Academic Performance By Occupational Therapy Students Using a Self-Study Format.
- School/Degree: North Carolina State University/Ed.D.
- Date: 1993
- Order Number: ADG93-17119. 9308.
- Abstract: This study was designed to investigate whether differences in preferred learning style might form the basis for differences in academic performance or personal satisfaction in occupational therapy students using a self-study instructional module. Increased competition for enrollment has shifted the demographics of the typical entering class towards a student population that is somewhat older, with higher grade point averages, and often with prior post-secondary degree training. Because of the change in demographics and the potential incompatibility with self-directed instruction, this study was undertaken to determine whether any of these parameters ultimately could be related to academic outcome. These results confirmed that the shift in demographic profile towards older students with higher grade point averages was accompanied by a fundamental difference in preferred learning style, but that neither academic performance nor personal satisfaction associated with the use of self-study course material were adversely affected by the shift in learning style. [134 pages]

## Research in Post-Secondary Settings

- Author: Muscia, Anthony J., Jr.
- Title: An Analysis of the Learning Styles of Entrepreneurs And Small Business Development Center Clients (Phoenix, Arizona).
- School/Degree: Nova University/D.B.A.
- Date: 1993
- Order Number: ADG93-23811. 9310.
- Abstract: This study was intended to determine if certain learning styles are predominant among individuals who seek counseling at Small Business Development Centers and among entrepreneurs who own and operate business ventures.
- The research findings indicated that none of the four learning styles are dominant among entrepreneurs.
- However, the data did indicate that entrepreneurs tend to score higher along the active experimentation dimension of the LSI than along the reflective observation dimension. In addition, they are also more likely to favor abstract conceptualization to concrete experience as their preferred mode of gathering and processing data. [102 pages]

## Research in Post-Secondary Settings

Author: Palmer, Jaellayna

Title: New Model, New Media: Applying 4MAT to Web-Based Training

Date: 1999

Available From: Unpublished Master's Thesis, University of Surrey

**Abstract:** This thesis suggests a practical model for fulfilling all learning style preferences identified in the 4MAT system through a Web-based course. The project includes a review of literature about adult education, learning styles, distance learning, and the impact technological change is having on course delivery. In an attempt to learn more about using technology to deliver courses that appeal to a variety of learning styles, practical research based on the literature and an investigation of current on-line courses were conducted. As the literature reveals, the 4MAT model has been linked with quality educational outcomes for face-to-face courses. Considering 4MAT's success in the classroom, the question explored is whether 4MAT, as a learning style model, can be applied successfully to a course delivered through technology.

Specifically, a course for the Ontario Agricultural Training Institute (OATI) was designed according to the constraints of the learning styles model 4MAT and delivered through the World Wide Web. This included simulating face-to-face processes through a computer interface.

The data submitted are both qualitative and quantitative. The key quantitative data are the results of a survey administered to 4MAT practitioners including a key question: In your opinion, has this course been 4MATed?, with all answering in the affirmative. Extending theory into practice, course-planning templates were developed; and, along with sample screen shots from the actual course, are included.

This work demonstrates that a learner-centric model, such as 4MAT can be applied to a Web-based course.

## Research in Post-Secondary Settings

Author: Pirkle, Barry A.

Title: A Relationship Between Leadership Styles and Learning Styles

School/Degree: Spalding University

Date: 1997

Abstract: The purpose of this paper was to research and to examine a rationale for developing a more effective and efficient means of providing leadership instruction. Learning styles and leadership styles were investigated and their relationships studied. The study included 41 subjects, doctoral students in education at Spalding University, Louisville, Kentucky. The instruments used were the Learning Type Measure, developed by Dr. Bernice McCarthy, author of the 4MAT Learning System. The Learning Type Measure was administered to the research subjects to determine preferred learning styles. The Leadership Style Behavioral Matrix, authored by Susan Sayer, was also given to all subjects to ascertain preferred leadership styles. Sections of the literature review included leadership training, leadership style theory, adult learning theory, learning style theory, and the 4MAT learning system. Results of the study indicated a relationship existed; however, most outcomes were not at a statistically significant level. In some specific instances, the results did indicate statistically significant results.

## Research in Post-Secondary Settings

Author: Ricci, Debra Mae  
Title: A Phenomenological Study of the Experience of Learning in Adult Higher Education  
School/Degree: University of Wisconsin, Madison / Ph.D.  
Date: 1999

Abstract: The purpose of this study was to return directly to the experience of adult learners in order to portray and better understand the essential nature of adult learning and to explore the different ways adults experience learning. Adult educators have understood adult learning according to several perspectives, but none of these have been derived from phenomenological examinations. Learning differences have been depicted in an array of cognitive and learning style models, particularly that of David Kolb and Bernice McCarthy. These have been criticized as simplistic and static ways of understanding learning.

The questions that guided this investigations were 1) What is the experience of learning for adults? What does it mean to learn? What is it like to learn for an adult? What happens when one learns as an adult? and 2) What are the different ways adults experience learning?

A phenomenological approach was used to gather and work with the data from twelve participants (ages 20 -50) in an undergraduate college course on negotiation. Adult learners were asked to reflect on their experiences as they learned to negotiate by writing weekly journals and then a final integration paper. Using phenomenological procedures to disclose meanings via the phenomenological reduction, the researcher prepared individual learning portraits for each participant. From these a composite textural description revealed 16 essential themes from which a general structural description was derived in answer to question 1. Finally, the variations within several themes were elaborated to explicate learner differences in answer to question 2.

The study revealed the essential nature of adult learning complex interaction of several components (themes) while also highlighting the unique expression of this essential structure by each individual. Findings also reveal more interactions between the learner's self-motivation, the learning situation, and several layers of the contextual environment than are depicted or implied in the Kolb and McCarthy instruments. Some support can be seen for the perceiving (grasping) and processing (transforming) dimensions of experiential learning theory underlying the Kolb and McCarthy models. To make appropriate use of learning styles instruments educators are advised to take careful account of motivational and contextual interactions that significantly influence expression of supposed learning style preferences in adult learners. Future research should attend to the uniqueness of individual learning experiences and focus on the role of motivational and contextual interactions.

## Research in Post-Secondary Settings

Author: St. Germain, Clif Ph.D, Marcus Leiberman, Ph.D and Moseta Cohen, Ph.D

Title: Reliability and Validity Study of the Learning Type Measure (LTM).

School/Degree: Action Research, About Learning, Inc.

Abstract: The purpose of the study was to determine a reliability coefficient for the Learning Type Measure (LTM). The LTM is a self-report instrument designed to help people understand and identify the differences in the ways people learn. Developed for use with the 4MAT System for teaching and leadership, the LTM is intended to provide guidance in all situations where learner differences play a role in communications and human interaction.

The subjects were 106 Community College Students enrolled in a Introduction to Education course in Florida. Each student was administered the Learning Type Measure at the beginning of the semester. After a period of 6 weeks the measure was re-administered. A Kappa Test was performed to determine if there was significant agreement between the first and second administration of the measure. Results indicate that the Learning Type Measure is a reliable as a measure of personal preference in learning.

# Research in Post-Secondary Settings

Author: St. Germain, Clif Ph.D, Marcus Leiberman, Ph.D. and Brian Mathiesen

Title: Replicated Validity Study of the Learning Type Measure (LTM)

School/Degree Action Research, About Learning, Inc.

Abstract The purpose of the study was to the further examine the validity of the LTM as a measure of individual differences in learning. This study involved 217 Australian engineering students. All subjects were given the Learning Type Measure (LTM), the Learning Style Indicator (LSI) and the Myers-Briggs Type Indicator (MBTI). LTM scores were then compared to Kolb's constructs of Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization(AC), Active Experimentation(AE), and Myers-Briggs Type Indicator (MBTI) constructs of Introversion (I), Extroversion (E), Sensing (S), Intuition (N), Thinking (T), Feeling (F).

Also examined in this study were descriptive aspects of the population as well as Grade Point Average (GPA) comparisons of the population by LTM most preferred and least preferred quadrant. Analysis of these data revealed the following:

- Quadrants 1 and 4 are significantly related to CE and are significantly different from Quadrants 2 and 3
- Quadrants 2 and 3 have the highest means on AC but the means were not statistically different from each other
- There is a statistically significant difference between LTM quadrant scores on RO comparisons, with quadrant 2 having the highest RO mean score
- There is a statistically significant difference between LTM quadrant scores on AE comparisons, with quadrant 4 having the highest AE mean score
- There is a statistically significant relationship between quadrant 1 scores and Feeling (F) and Sensing (S), and quadrant 4 scores and Intuition (N)
- There is a statistically significant relationship between quadrant 2 scores and Thinking (T)
- There is a statistically significant relationship between Introversion (I) and Watching (W), and Extroversion and Doing (D)
- With regard to Watching (W): 2 is most watching, 1 is watching, 3 is doing and 4 is most doing
- LTM distribution for this sample was as follows:Quadrant 1 = 12.9%, Quadrant 2 = 15.2%, Quadrant 3 = 49.8% , Quadrant 4 = 22.1%

• GPA comparisons for this sample were as follows:

<i>Quadrant</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Most Preferred Quadrant	4.29	4.45	4.24	3.74
Least Preferred Quadrant	4.31	3.73	4.04	4.43

- For Least Preferred, Quadrant 1 was least preferred for 2's, 3's, and 4's (note: in this sample of engineering students quadrant 3 made up 49.8% of the sample)

The data presented in this study clearly establish high levels of correlation between the LTM and individual constructs on the LSI and MBTI. Other descriptive comparisons reported in this study will constitute the basis of future investigations.

## Research in Post-Secondary Settings

- Author: Vare, Jonatha; Dewalt, Mark W.; Dockery, E. Ray
- Title: Predicting Student Retention in Teacher Education Programs
- Publication: Paper presented at the annual meeting of the American Association of Colleges for Teacher Education, Chicago, Illinois, February 28, 2000
- Available from: Center for Pedagogy, College of Education, Winthrop University, Rock Hill, SC 29733.
- Description: Researchers describe preliminary results from a longitudinal study of attrition and retention. The sample consisted of 316 students in an initial course in teacher education. Data collection included the following: high school GPR; SAT scores; other demographic information such as education of the father and mother; and scores on the Learning Type Measure (LTM) which reports four learning styles or types (quadrants 1-4). Multiple regression analysis revealed four significant variables that predicted spring GPR in descending order: (1) SAT-V score; (2) high school GPR; (3) level of father's education; and (4) thinking/reflection (quadrant 2) score on the LTM. Researchers discuss implications for college retention based on these data. Programs should be more closely tailored to the needs of particular subgroups. Students with lower SAT-V scores may need assistance in study skills and areas of academic instruction. First-generation college students require a different form of assistance such as special advising sessions to discuss unfamiliar processes. Students with varied learning types may perform better when instruction matches their preferred learning styles.

## Research in Post-Secondary Settings

Author: Zack, Carol Wolfe

Title: The Relationship Between Self-Knowledge of Personal Learning Style And Academic Choices Made by Freshmen College Students.

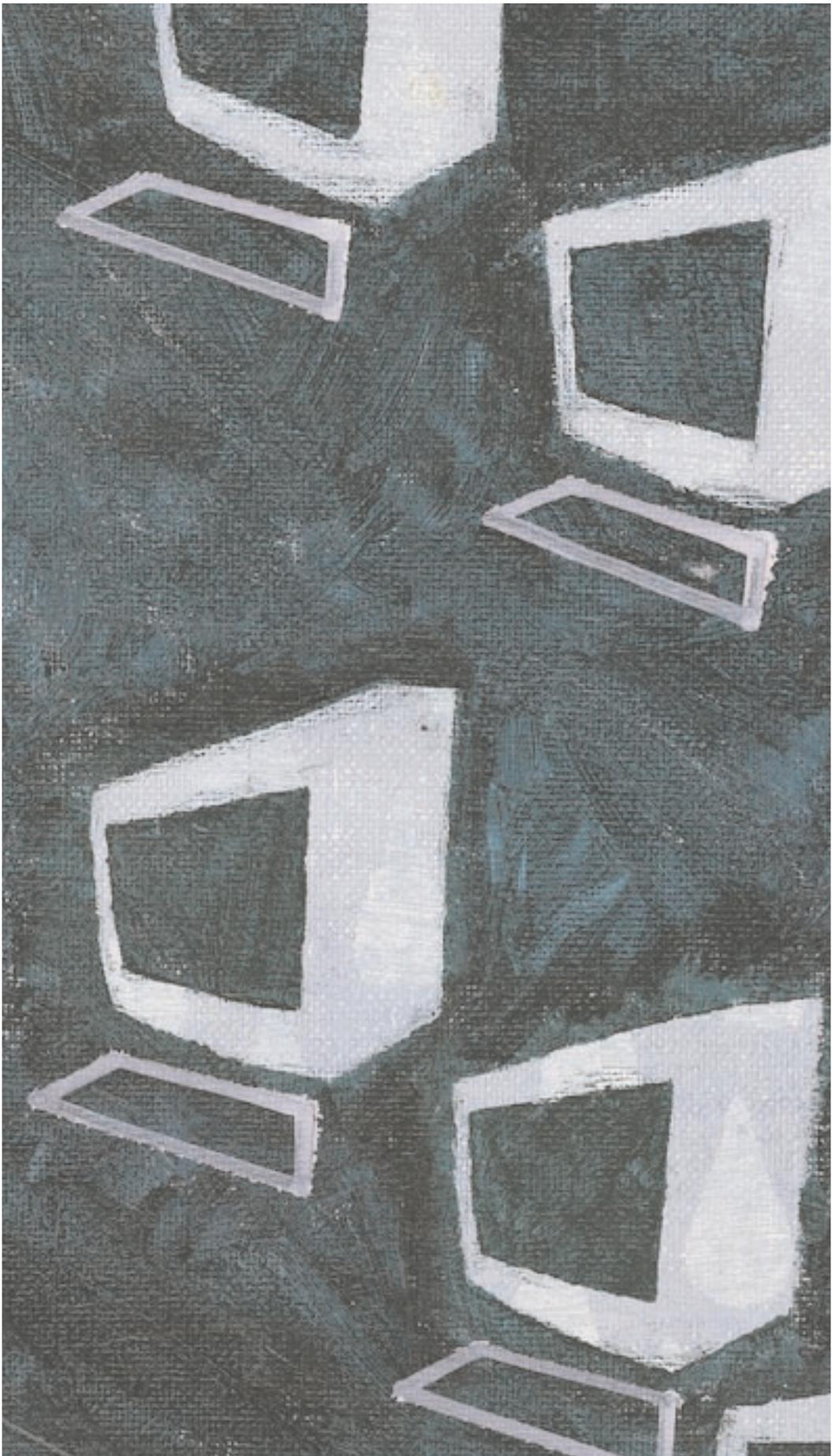
School/Degree: The Pennsylvania State University/D.Ed.

Date: 1991

Order Number: DA9214302

Abstract: This study was designed to explore the relationship between self-knowledge of personal learning style and the academic choices, including study habits, course election, choice of major, and career choices made by freshmen college students.

The data revealed a relationship between freshman major selection and individual learning style. This relationship occasionally followed the patterns found by Kolb in his studies of learning styles, college major, and career choice. No relationship was found between self-knowledge of personal learning styles and the effect of that knowledge on study habits, college major selection, or lifelong career goals. [99 pages]



## Articles on 4MAT and Related Topics

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Title: Application of the 4MAT Model to Career Guidance.  
Author: Allyn, Donna Proske  
Publication: *The Career Development Quarterly*, Vol. 37, pp. 280–288, March, 1989.  
Available from: UMI  
Description: Contends the application of The 4MAT System Model to the career guidance process for college students will provide career counseling practitioners with answers, based on learning theory, to when they should use which career counseling and tools, and answers as to why they are using them at that particular point in the curriculum.

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Title: Integrating Styles and Skills: An Approach to Lesson Planning for the ESL Classroom.  
Author: Arnold, Nancy; And Others  
Publication: Arlington County Public Schools, VA; Center for Applied Linguistics, Washington, DC. Center for Language Education and Research. 1987  
Agency: Office of Educational Research and Improvement (ED), Washington, DC.  
Description: A guide to developing lesson plans for classroom instruction in English as a second language (ESL) based on learning style theory draws on the experience of the Arlington County Schools (Virginia). It begins by describing the theory of learning styles, their applications, and the process of developing lesson plans by “4MATing,” which postulates that there are four major styles of learning and ensures that learners have an opportunity to learn in the mode they prefer.  
  
The guide then gives a sample lesson plan description and discusses Arlington’s staff development activities directed toward integrating the 4MAT Model in the curriculum. The guide concludes with six sample lesson plans on these topics: learning about yourself, learning how to report emergencies in the United States, planning for the future, comprehending a reading section and applying it to everyday life, understanding the similarities and differences in nature, and stimulating creative thinking and writing with a concrete object. Additional reading recommendations are also included.

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Title: Improving College Teaching through Adapting Learning Styles Theory into Practice.  
Author: Ault, Kay  
Publication: Paper presented at the Annual Meeting of the Midwest Regional Conference on English in the Two-Year College (21st, St. Louis, MO, February 13–15, 1986).  
Description: Learning styles theory on how people learn has been known for at least 25 years. Yet, for the most part, college teachers still dispense information in the traditional lecture/exam method without regard for the differing learning styles of

## Articles on 4MAT and Related Topics

their students. This study, conducted at North Central Technical College in Mansfield, Ohio, demonstrates the feasibility of adapting learning styles theory to college students' learning preferences. A simplified version of McCarthy's 4MAT System was implemented in two General Studies courses. Results demonstrated significant improvement in student attitudes after their experience with the 4MAT Model. Conclusions support the effectiveness of teaching to learning styles at the college level, in terms of improved student attitudes and performance, and increased teacher satisfaction and effectiveness in the classroom. Recommendations include institution-wide training in and support for teaching methods which accommodate differing learning styles of students. (Author)

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- Title: Keeping Current: Doing It with Style for Different Folks: Learning Styles for School Library Media Specialists
- Author: Barron, Daniel D.
- Publication: *School Library Media Activities Monthly*, v14 n2 p48-50, October, 1997. EJ552471
- Description: Understanding learning styles can help teachers get beyond lecture, text, and test. This article reviews some of the research and literature on learning styles, highlighting the Myers-Briggs Type Indicator, the Keirsey Temperament Sorter, the 4MAT System, and Attention Deficit Disorder (ADD). Includes related Web sites and print resources.
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- Title: Interactions between Hemisphericity and Learning Type, and Concept Mapping Attributes of Preservice and Inservice Teachers.
- Author: Bitner, Betty L.
- Publication : Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, April 1996. ED400196
- Description: The purpose of this study was to determine whether hemisphericity and learning type are related to concept mapping attributes of preservice and inservice teachers. In addition, differences in concept mapping by program (i.e., preservice elementary/middle school and secondary science teachers and inservice elementary/middle school teachers), learning type, and hemisphericity were investigated. Hemisphericity and learning type were measured by the Hemispheric Mode Indicator and 4MAT Learning Type Measure respectively. Concept maps were constructed by the teachers and scored on a seven attribute rubric. Statistically significant interrelations were found between hemisphericity and learning type as well as between the attributes within the concept maps. However, concept mapping attributes did not correlate significantly with hemisphericity and learning type. The ANOVA (Analysis Of Variance) indicated that the inservice elementary/middle school teachers performed significantly better in concept mapping than the preservice elementary/middle school and secondary science teachers.
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## Articles on 4MAT and Related Topics

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Title: Need a Strong Foundation for an Interdisciplinary Program? Try 4MAT

Author: Blair, Dee; Judah, Sherry Selph

Publication: *Educational Leadership*, Vol. 48, No. 2, pp. 37–38, Oct 1990.

Available from: UMI

Description: In Monroe County (Indiana), an innovative new state program, Technology Preparation, ensures that high school students' coursework offers practical applications of academic concepts to real-life situations. The 4MAT Model helped teachers build the Tech Prep program by sensitizing them to individual learning styles, including their own.

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Title: 4MAT/Formating The Accounting Curriculum

Author: Borkowski, Susan & Mary Jeanne Welsh

Publication: *Accounting Educator's Journal*, Volume VIII, Number 2, 1995

Description: This paper presents an integrative approach to teaching known as the 4MAT System<sup>®</sup>, which provides a framework for integrating experiential and collaborative learning assignments in a conceptual approach to content. Instruction is systematically structured to reach students with different learning styles and processing preferences. McCarthy's 4MAT System is based on Kolb's experiential learning model, Jung's psychological types, and research on left brain/right brain processing. The underlying theory is summarized, and then the integration of the theory into the 4MAT System is discussed. We then present 4MAT as it is applied in both a "Job Order Costing" introductory accounting course and the "Standard-setting Process" in an intermediate accounting course.

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Title: 4MAT: A Method of Stimulating Holistic Learning

Author: Brekke, Mary E.

Publication: *Journal of Nursing Education*, Vol. 25, No. 5, pp. 215–217, May, 1986.

Available from: Metropolitan State University, Minneapolis, MN

Description: The author explains basic concepts of 4MAT and describes how 4MAT was used in a planned change class taught in the nursing program of Metropolitan State University, St. Paul, Minnesota. When applied, 4MAT proved to be a valuable tool. Students demonstrated a high level of enthusiasm, prepared excellent papers and gave positive evaluations. As a result, objectives in other curriculum content areas have come under review, and 4MAT will be integrated into other portions of the nursing program.

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## Articles on 4MAT and Related Topics

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Title: A Study of Learning Styles and Computer-Assisted Instruction.  
Author: Cordell, Barbara J.  
Publication: *Computers and Education*, Vol. 16, No. 2, pp. 175–83, 1991.  
Available from: ERIC  
ISSN: 0360-1315  
Description: Describes study of health care employees that was designed to determine whether learning styles affect outcomes of learning with two computer-assisted instruction (CAI) design strategies, linear and branching. Use of the 4MAT Learning Styles Inventory is explained, and implications of the results for educators and courseware designers are suggested. (20 references)

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Title: Power Learning: Racing Ahead of Your Competition  
Author: Correll, James G.  
Publication: Paper presented at the American Production and Inventory Control Society, 1996.  
Available from: Annual International Conference Preceedings – American Production and Inventory Control Society 1996. APICS, Falls Church, VA, USA.  
Description: If the only sustainable form of competitive advantage is the application of knowledge, companies should make learning effective. The 4MAT learning model can assist companies in staying ahead of the competition by getting immediate and lasting results from training and education programs.

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Title: Using the 4MAT System Learning Styles Model To Teach Persuasive Speaking in the Basic Speech Course.  
Author: Dwyer, Karen  
Publication: A conference paper presented to the Southern States Communication Association, 1993.  
Description: This paper describes the 4MAT System with special reference to teaching communication and developing units of study for speech instruction. The author explains how using 4MAT strategies increases student interest and performance. Also described in this paper are sample units of instruction.

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## Articles on 4MAT and Related Topics

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**Title:** Increasing Mammography and Breast Self-examination in African American Women Using the Witness Project Model

**Author:** Erwin, Deborah, Spatz, Thea et. al.

**Publication:** *Journal of Cancer Education*, Volume 11, Number 4, 1996.

**Description:** The five-year survival rate for African American women with breast cancer is notably lower than the rate for white women; thus, appropriate cancer education and screening efforts are needed to increase mammography and self-examination practices by African American women. **Methods.** The Witness Project is a theory-based intervention designed to provide culturally sensitive messages, from African American breast cancer survivors, in churches and community organizations. These messages emphasize the importance of early detection to improve the chances of survival. Development of the Witness Project was influenced by Dr. Thea Spatz's experience in designing cancer education information for various learning styles and brain hemispheric preference. Using the 4MAT system as a template, project interventions use experiential learning techniques to create a personal connection between the messenger and the audience, augment didactic presentations, and deliver information in a non-threatening, effective manner. Results are as follows: Intervention research in eastern Arkansas, involving 204 African American women, demonstrated a significant increase in the practice of breast self examination ( $p < 0.001$ ) and mammograph ( $p < 0.001$ ) after participation in the Witness Project. There was no significant difference between the prevention and postintervention scores for scaled items for the health-belief model and locus of control. **Conclusions.** Results demonstrate that culturally appropriate cancer education programs are able to change behavior by meeting the beliefs of participants rather than attempting to change their beliefs.

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**Title:** School Principals and Change Processes in the Secondary School.

**Author:** Fullan, Michael G.; Newton, Earle E.

**Publication:** *Canadian Journal of Education*, Vol. 13, No. 3, pp. 404–22, Summer 1988.

**Available from:** UMI

**Description:** Case studies of three urban high-school principals provide insights into events that affected the adoption and implementation of The 4MAT System of classroom instruction for two years. The principals' roles as managers, strategies for involvement, sources of pressure and support, and roles of teachers and district personnel are emphasized.

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## Articles on 4MAT and Related Topics

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- Title: The Hemispheric Nature of the Brain an Elementary School Language Arts.  
Author: Furtney, Camille  
Publication: Reading Improvement, vol. 28, p293-99 Win 1991  
Available from: UMI  
Description: This article provides relevant background information about the hemispheric nature of the brain. It also presents a framework for resulting practical implications for elementary school language arts teaching. The author notes that both perspective and practicing elementary school teachers should find this linkage of theory and practice beneficial as they help children gain language arts proficiency.
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- Title: On Mixing and Matching Teaching and Learning Styles  
Author: Gephart, William J., Deborah B. Strother, Willard R. Duckett  
Publication: *Practical Applications of Research*, Vol. 3, No. 2, December, 1980.  
Available from: Phi Delta Kappa, Center on Evaluation, Development, and Research, Bloomington, Indiana  
Description: A description of the work of David Hunt, Anthony Gregory, David Kolb, and Bernice McCarthy with an emphasis on the question of whether to match students' styles to teaching styles. The authors raise the issue of complexity and reciprocity in teaching and suggest a give-and-take between students and teachers is necessary which they liken to "the metaphor of orchestrating two instruments playing together or spontaneously alternating variations on a theme". The 4MAT System is explained in some detail and the authors conclude that teachers need to understand the differences in how students learn to be maximally effective.
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- Title: Marching to Different Drummers. 2nd Edition.  
Author: Guild, Pat Burke; Garger, Stephen  
Available from: Association for Supervision and Curriculum Development, 1703 n. Beaugard Street, Alexandria, VA 22311-1714. 1-800-933-2723. <http://www.ascd.org>  
Description: This revised edition focuses on diversity in education, exploring differences in style to help educators better fulfill their responsibilities and to assist people in realizing their potential. New chapters discuss the importance of knowledge about students' culture, learning styles in light of recent discoveries about the functioning of the brain, and how learning styles relate to the theory of multiple intelligences. The text focuses on seven major research models and their applications: Carl Jung, Herman A. Witkin, Walter Barbe and Raymond Swassing, Rita Dunn and Kenneth Dunn, Anthony Gregorc, Bernice McCarthy, and Howard Gardner. An additional section addressing diversity identifies common questions and discusses applications, implementation, and staff development. A comprehensive annotated bibliography is included.
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## Articles on 4MAT and Related Topics

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Title: Integrating Learning Styles and Skills in the ESL Classroom: An Approach to Lesson Planning.

Author: Hainer, Emma Violand; and others

Publication: *National Clearinghouse for Bilingual Education*, Washington, D.C., 1990. p. 31.

Available from: Office of Bilingual Education and Minority Languages Affairs (ED), Washington, D.C.

Contract No: 289004001

Description: Strategies and lessons are reported that were developed by a team researching learning styles of language minority students. The research incorporated work done in the Arlington County, Virginia program, English for Speakers of Other Languages—High Intensity Language Training (ESOL-HILT). The Arlington instructional model for LEP students has evolved from making it the students responsibility to adjust to the unfamiliar, to meeting the students where they are and helping them to broaden their learning horizons. The approach involves students' opportunities to learn. The experiential 4MAT learning model was used to achieve those goals. This guide, intended to be a springboard for designing more effective learning activities, reviews learning styles theory, learning styles applications (for “innovative,” “analytic,” “common sense,” and “dynamic” learners), and adaptation of the 4MAT system for developing lesson plans. Six detailed lesson plans are presented, each with motivation, concept development, practice, and application components. Contains 17 references, some of which are annotated.

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Title: Use of the Kolb Learning Cycle and the 4MAT System in Engineering Education

Author: Harb, John N.; Durrant, S. Olani; Terry, Ronald E.

Publication: *Journal of Engineering Education*. April, 1993. p70-77

Description: The purpose of this paper is to discuss and illustrate the application of the Kolb model and McCarthy's 4MAT system to engineering education. Specific objectives for each of the four learning quadrants are defined. Sample lesson plans illustrate applications of the learning cycle to the teaching of specific engineering topics.

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## Articles on 4MAT and Related Topics

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Title: Celebrating Students' Diversity through Learning Styles.

Author: Hilgersom-Volk, Karin, Oregon School Study Council, Eugene.

Publication: *OSSC Bulletin*, Vol. 30, No. 9, May 1987.

Available from: Publication Sales, Oregon School Study Council, 1787 Agate Street, Eugene, OR 97403 (\$4.00 prepaid; quantity discounts; add \$1.50 for postage and handling on billed orders).

Description: While teachers are becoming increasingly aware of different learning styles, they have generally rejected the practical use of learning styles in the classroom. This bulletin summarizes theories and findings on learning styles, demonstrates their use in exceptional and regular classrooms, and offers recommendations for those who want to use the learning style approach. Chapter 1 begins by defining learning styles and summarizing the pioneering efforts of Rita Dunn, Anthony Gregory, and Bob Samples. The chapter next summarizes learning styles research and the development of various instruments, including the Learning Style Inventory, ORGANON, and The 4MAT System. Studies of students' preferences concerning lighting, room temperature, mobility, scheduling, and other factors are examined for their effects on academic achievement. Chapter 2 summarizes interviews with teachers involved in Oregon's Talented and Gifted (TAG) program and regular teachers experimenting with learning styles methods in their classrooms. A middle school teacher, for example, reports good results with students who fail written tests, but excel when allowed to discuss their knowledge. Chapter 3 underlines the importance of learning styles theory to educational reform and recommends several steps for adopting this emphasis, including: gaining administrative support; coordinating preservice teacher training; involving teachers, parents, and students; and developing a solid research base. Included are a bibliography of 14 references and a list of 10 interviews.

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Title: The Relationship Between Student Learning Style and Performance on Various Test Question Formats.

Author: Holley, Joyce H.; Jenkins, Elizabeth K.

Publication: *Journal of Education for Business*, Vol. 68, No. 5, May–June, 1993.

Available from: UMI

ISSN: 0883-2323

Description: The relationship between performance on four test formats (multiple-choice theory, multiple-choice quantitative, open-ended theory, open-ended quantitative) and scores on the Kolb Learning Style Inventory was investigated for 49 accounting students. Learning style was significant for all formats except multiple-choice quantitative.

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## Articles on 4MAT and Related Topics

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Title: Formal Operations and Learning Style Predict Success in Statistics and Computer Science Courses.

Author: Hudak, Mary A.; Anderson, David E.

Publication: *Teaching of Psychology*, Vol. 17, No. 4, pp. 231–34, Dec., 1990.

Available from: UMI

ISSN: 0098-6283

Description: Studies 94 undergraduate students in introductory statistics and computer science courses. Applies Formal Operations Reasoning Test (FORT) and Kolb's Learning Style Inventory (LSI). Finds that substantial numbers of students have not achieved the formal operation level of cognitive maturity.

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Title: Using the 4MAT Instructional Model for Effective Leadership Development

Author: Kaplan, Leslie Schenkman

Publication: Bulletin. September, 1998, v82 n599 p.83-92.

Available from: The National Association of Secondary School Principals. 1904 Association Dr., Reston, VA 20191-1537

Description: Expectations for principals as the “teachers of adults” is increasing. The 4MAT instructional model provides a user-friendly, research-based structure for principals to design powerful retreats and workshops. Using the 4MAT workshop helps principals act as instructional leaders to increase leadership behavior among all educators in their school. Three workshops for staff development are presented in this discussion.

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Title: Using 4MAT in Law School

Author: Kelly, Cynthia

Publication: *Educational Leadership*, Vol. 48, No. 2, pp. 40–41, Oct., 1990.

Available from: UMI

Description: An associate law professor recounts the incompatibility of her own professors' analytical teaching methods with her dynamic learning mode. Since learning the 4MAT principles, she has used alternative approaches to help law students move from experiential learning to abstract thought, to practical theory applications, and to development of new theory based on life experiences.

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## Articles on 4MAT and Related Topics

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Title: Using 4MAT to Improve Staff Development, Curriculum Assessment, and Planning.  
Author: Kelley, Lynn S.  
Publication: *Educational Leadership*, Vol 48, No. 2, pp. 38–39, Oct., 1990.  
Description: After an I/D/E/A conference on 4MAT learning styles, a Colorado school district developed a site-based staff development program with numerous spin-off offerings and applications. Teachers are using the 4MAT process to restructure curriculum and assess student learning in innovative ways.

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Title: Left Brain/Right Brain Theory: Implications for Developmental Math Instruction.  
Author: Kitchens, Anita N.; and others  
Publication: Appalachian State Univ., Boone, NC. Center for Developmental Education, Vol. 8, No. 3, 1991.

Available from: Managing Editor, Review of Research in Developmental Education (RRIE), National Center for Developmental Education, Appalachian State Univ., Boone, NC 28608.

Description: Perhaps the most dramatic failure in postsecondary education has been in the teaching of mathematical skills. The different functions of the right and left hemispheres of the brain require different approaches to education. Due to their emphasis on language and verbal processing, schools have failed to give adequate stimulation to the right side of the brain and thus tend to discriminate against right brain (RB) dominant students. Many students show a preferred RB (intuitive) thinking style and consequently have struggled in school because their thinking style did not conform to typical left brain (LB) or logic-based instruction and testing. LB dominant students were generally successful in algebra, while RB students tended to succeed in classes involving trigonometry, conics, vectors, and complex numbers. Findings of one study show that in a beginning calculus course, 70% of unsuccessful students were LB, even though there was no significant difference in successful LB versus RB students.

Although there has been research which casts doubt upon the validity of the LB/RB distinction, it is clear that students approach problem solving from either an intuitive or logical point of view, and educators must accommodate both learning styles. Instructors must teach students the difference between LB and RB styles of thinking. They should show how different thinking styles could have led to negative classroom experiences which in turn could be at least partly responsible for a difficulty in learning math. A list of 25 references is included.

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## Articles on 4MAT and Related Topics

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- Title: The Role of In-School Administrators in Bringing about Curricular Change: The Principal's Perspective.
- Author: Lacey, Veronica S.; And Others, North York Board of Education, Willowdale (Ontario). 1986
- Publication: Paper presented at the Annual Meeting of the American Educational Research Association (67th, San Francisco, CA, April 16–20, 1986).
- Description: This paper outlines, from the perspective of three school principals, the complexities involved in implementing a curriculum innovation, "4MAT," begun in Ontario in 1984. Curriculum project considerations include: leadership skills necessary; importance of support systems for principals; role of research; role of the principal; project implementation; and outcomes. Objectives include: raising staff awareness in learning styles; developing 4MAT-based curriculum; implementing 4MAT examples in the classroom; and improving staff communication.

The paper reviews outcomes attributable thus far to implemented 4MAT units. Data collection assessed effects of 4MAT on students and the learning environment. Because standardized achievement tests were not appropriate measures for these short-term study units, each 4MAT unit contained a "teacher designed" evaluation component. Future scores could be compared with a control group. Student self-concept and attendance rates may change with this approach.

A checklist will document classroom events that represent the four learning styles. Interviews with teachers and students may determine the usefulness of 4MAT. Results so far are that teachers are working together with greater facility and that curriculum is being written more systematically with 4MAT principles. Costs of curriculum change among the three schools have been heavy, but the effort has already paid dividends that will compound in 1986–88 and beyond.

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- Title: Learning Styles: Not All Kids Learn in the Same Way
- Author: Le Fever, Marlene
- Publication: *Foundations: The 1986 Resource Guide for Church Educators and Youth Workers*, pp. 38–40, Spring, 1986.
- Available from: SMI Publications, Inc. Evanston, Illinois
- Description: A description of Bernice McCarthy's 4MAT System and its possible adaptation to Sunday School teaching and curriculum. The author concludes that the use of 4MAT can help capture and involve all the students.
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## Articles on 4MAT and Related Topics

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Title: Learning  
Author: Le Fever, Marlene  
Publication: *Youthworker*, Vol. VIII, No. 1, pp. 96–100, Summer, 1991.  
Available from: Youthworker, El Cajon, CA 92021  
Description: An interview by Marlene LeFever, Manager of educational services for David C. Cook Publishing, with Bernice McCarthy. The interview highlights student reactions when they discover the legitimacy of their diverse learning styles. Also includes a detailed descriptions of each of the eight steps of the 4MAT cycle.

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Title: The 4MAT System: An Interview with Bernice McCarthy.  
Author: Leflar, Susan Morris; McCarthy, Bernice  
Publication: *Journal of Developmental & Remedial Education*; Vol. 6, No. 2, pp. 14–17, 29, 1983.  
Available from: UMI  
Description: Explores the experiences and research which led Bernice McCarthy to advocate the goal of deliberately helping students to develop skills and potential inherent in each hemisphere of the brain. Describes The 4MAT System, which equally emphasizes four learning styles (i.e., experience, active experimentation, reflective observation, and abstract conceptualization).

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Title: Inductive Preaching  
Author: Lewis, Ralph L.  
Publication: *Inductive Preaching: Helping People Listen*, Crossway Books, Asbury Theological Seminary Wilmore, KY, 1983, pp. 19–22.  
Available from: Ashbury Theological Seminary, Wilmore, KY 40390  
Description: The author incorporates findings from brain and learning style research to support the validity of inductive preaching. He gives concrete examples of activities that will involve people in learning wholistically, through induction. He discusses McCarthy's theories of learning as a reason to address all learning styles. He puts particular emphasis on right and left brain differences and presents a most comprehensive list of claims regarding brain hemisphere characteristics based on research from 1961–1983.

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## Articles on 4MAT and Related Topics

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**Title:** Integrating Teaching Styles with Students' Learning Styles

**Author:** Lippitt, Linda; And Others

**Publication:** Santa Fe Indian School, NM., Department of Education, Washington, DC 1993. ED406068

**Description:** This document begins with a report of a study of the learning styles of American Indian students at the Sante Fe Indian School (New Mexico). Santa Fe Indian School is a secondary school of 550 students, primarily from the Pueblo communities of New Mexico. A learning style assessment instrument was administered to 459 students, Grades 7-12, in 4 tribal language groups. A preferred instructional style was not found overall or for any of the tribal language groups. Analysis of student profiles suggests that teaching strategies and curriculum should focus on: small-group learning activities; developing a positive rapport between teachers and students; augmenting information-processing skills that address right and left hemispheric approaches to learning; and developing a flexible instructional delivery that incorporates information on individual learning styles. Following the report, 14 social studies and language arts lesson units, developed for Indian middle school students as a result of the study are presented, based on the 4MAT instructional model that acknowledges a diversity of learning styles and incorporates both right and left hemispheric modes of learning. The units cover various topics related to American Indian history and culture, cultural exchange, outdoor education, study skills, and thinking skills. Each unit consists of lesson plans and learning activities related to creating and analyzing an experience; integrating experience with analysis; teaching practicing, and personalizing the concept; analyzing personal application; and celebrating knowledge gained.

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**Title:** Out of the East Horizon: Chinese Art from the Seattle Art Museum.

**Author:** Loudon, Sarah M., Liu, Lucy

**Publication:** National Endowment for the Humanities (NFAH), Washington, D.C., Seattle Art Museum, WA. 1988. ED410174

**Description:** As the artistic and intellectual elite of their society, Chinese scholars had to be educated in a number of fields including music, poetry, painting, and calligraphy. This teacher resource packet, which includes an audiotape and 16 color slides with a descriptive script and comprehensive lesson guide, examines some of the arts associated with the traditional Chinese scholar. The packet is designed to be used by general classroom teachers of upper elementary students, but may be adapted for use with younger and older students. The multidisciplinary unit is organized in 5 sections: (1) "A Room for Inspiration: The Chinese Scholar's Studio"; (2) "The Painted Word: Chinese Language and Art"; (3) "The Chinese Scholar's View of Nature"; (4) "Slide List"; and (5) "References." Thirteen individual lessons, given in the 3 instructional units, are sequentially ordered to build on each other and are designed to accommodate student learning styles as indicated by the 4MAT System. Each lesson focuses on a slide image or on provided student handouts and worksheets. Objectives,

## Articles on 4MAT and Related Topics

procedures, activities, and questions for conclusion and evaluation are given. Supplementary materials include an audiotape of Chinese music and overlay diagrams of brushstrokes. Contains 32 bibliographic and resource references, and a pronunciation guide.

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- Title: Learning Styles: Implications for Teaching
- Author: Lourds Stevens and Stanley Hanna
- Publication: *Passages: A Journal of Refugee Education*, Vol. 4, Nos. 1 and 2, pp. 23–26, Spring and Summer, 1988
- Available from: The Center for Applied Linguistics, funded by the Bureau for Refugee Programs of the U.S. Department of State: 1118 22nd St. NW, Wash, DC.
- Description: A description of the training program for Filipino teachers who instruct Indochinese refugees in English, and cultural and work orientation for their new lives. The program gives instruction in how to use The 4MAT System which the authors believe is a multicultural approach to help unique individuals reach their full potential. In addition to describing the teacher training program, an overview of 4MAT is given.
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- Title: A Tale of Four Learners: 4MAT's Learning Styles
- Author: McCarthy, Bernice
- Publication: *Educational Leadership*, Volume 54, number 6, 1997
- Description: In this article, Bernice McCarthy describes what she has learned about how all learners move through a natural cycle of learning ( a movement from feeling to reflecting to thinking and, finally, to acting). Written specifically for an *Educational Leadership* special edition on How Children Learn, McCarthy describes how The 4MAT® System builds upon learning style to help students move through the learning cycle, and grow by engaging less preferred aspects of their style. Using descriptions of four distinct types of learners, McCarthy offers suggestions for engaging both sides of the brain, assessing the whole student, and aiming for balance in teaching. According to Dr. McCarthy, "Teachers need not label learners according to style, just help them work for balance and wholeness."
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## Articles on 4MAT and Related Topics

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Title: Improving Staff Development through CBAM and 4MAT.

Author: McCarthy, Bernice

Publication: *Educational Leadership*, Vol. 40, No. 1, pp. 20–25, Oct. 1982.

Available from: Reprint: UMI

Description: The seven-step Concerns-Based Adoption Model (CBAM) outlines the stages people move through when adopting an innovation. The 4MAT System applies learning style research and research on brain dominance to teaching practices. When combined, the two systems form a comprehensive model for staff development.

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Title: What 4MAT Training Teaches Us about Staff Development.

Author: McCarthy, Bernice

Publication: *Educational Leadership*, Vol. 42, No. 7, pp. 61–68, Apr. 1985.

Available from: UMI

Description: Describes The 4MAT System, an instructional plan adapted to diverse learning styles, and suggests ways for teachers to use the system. Includes seven recommendations for staff development.

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Title: Using The 4MAT System to Bring Learning Styles to Schools.

Author: McCarthy, Bernice

Publication: *Educational Leadership*, Vol. 48, No. 2, pp. 31–37, Oct. 1990.

Available from: UMI

Description: 4MAT is an eight-step instructional cycle that capitalizes on individual learning styles and brain dominance processing preferences. The four major learners (imaginative, analytic, common sense, and dynamic) can use 4MAT to engage their whole brain. Learners use their most comfortable style while being challenged to function in less comfortable modes. Includes 13 references.

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## Articles on 4MAT and Related Topics

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Title: Making Connections: Four Educational Perspectives. Occasional Paper Series. AEL Occasional Paper 29.

Author: Miller, Maryrita G., Ed.

Publication: *Appalachia Educational Lab.*, Charleston, WV. May, 1989. p. 83; Proceedings of Radford University's Symposium for Educational Leaders (Roanoke, VA, February 23–24, 1989).

Available from: Appalachia Educational Laboratory, Inc., P.O. Box 1348, Charleston, WV 25325.

Contract No.: OERI-400-86-0001

Description: This symposium was designed to promote the formation of an instructional system that would incorporate the best instructional methodologies. Four papers were presented, each dealing with an acknowledged approach to teaching. The first paper emphasizes the importance of effective curriculum design, a facet of direct instruction that assists teachers, through the use of explicit frameworks and specific instructional examples, in making connections for students. The second paper presents aspects of 4MAT, a system that assists educators in designing instruction that focuses on all four learning styles. Brain dominance differences are discussed. In the third paper, a model for invitational education is presented, emphasizing the collaborative and cooperative processes in developing a school climate in which learning can be enhanced. The fourth paper explores connections between the need to develop the thinking skills of all students and each of the four instructional approaches, including cooperative learning, direct instruction, invitational education, and learning styles. Graphic notes, "mind maps," accompany the papers to facilitate an organizing schema. Results of evaluations of the symposium follow the presenters' papers, along with an epilogue written by a participant. The symposium agenda and biographical information on the presenters is appended.

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Title: Learning Styles: A Practical Approach to Retention

Author: Mills, Joan

Publication: *University of North Carolina, The Journal of Student Services*, pp. 29–38, August, 1984.

Available from: University of North Carolina at Chapel Hill

Description: The author describes the theories of Carl Rogers, Benjamin Bloom, Roger Sperry, David Kolb, Arthur Whimby and Bernice McCarthy as a research base for the need for more innovative programming for college students. She includes four different areas of student life in which these person-centered approaches are particularly useful: counseling, academic advising, tutoring and classroom teaching. She argues that traditional teaching methods "have inculcated rigid, non-creative students responses", and posits the theory that using teaching models like 4MAT can help learners flourish both intelligently and emotionally.

## Articles on 4MAT and Related Topics

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Title: The 4MAT System: An Experiment.  
Author: Mills, Rob  
Publication: Journal of Developmental & Remedial Education, v6, 1983. EJ284270  
Description: Presents research results comparing students' course content mastery in two study skills classes, one using traditional teaching methods and one utilizing McCarthy's 4MAT teaching model. 4MAT takes brain dominance into consideration and suggests specific instructor roles for students grouped according to learning style.

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Title: Learning Styles: Putting Research and Common Sense into Practice.  
Association Publication: National Association of Secondary School Principals  
Publication: American Association of School Administrators, Arlington, Va., 1991. ED342099  
Description: The instructional techniques currently in use in many classrooms across the country were developed to teach children the "basics" and to instill good working habits adaptable to the industrial age. Although the term "learning style" first appeared in research literature in the 1950s, it did not burst upon the education scene significantly until the 1970s. Recently, educators and researchers have combined their increasing interest in the nature and uses of intelligence with scientific knowledge about how the brain works. In addition, there have been numerous cumulative studies on the effects of cultural, social, and physical contexts on learning. The result is a much wider base for understanding how children learn. This booklet discusses the movement from a focus on physical, observable behavior (external) to cognitive/affective factors (internal). The document discusses several theories about learning styles, all of which focus on the student's individual characteristics and ways in which they process information. Common problems in assessing the learning styles of students are addressed, as well as the most common assessment programs (Reading Style Inventory, NASSP Learning Style Profile, and the 4MAT System). The last chapter answers questions educators may have about how to incorporate learning styles into their classrooms and discusses the best climate for style-based learning.

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## Articles on 4MAT and Related Topics

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Title: Learning Styles And Brain Hemisphericity of Technical Institute Students.  
Author: Petty, Gregory C.; Holtzman, Fred  
Publication: *Journal of Studies in Technical Careers*, Vol. 13, No. 1, pp. 79–91. Winter, 1991.  
Available from: UMI  
ISSN: 0163-3252  
Description: A study of adult students entering postsecondary institutions (n=187) found that their brain dominance was significantly related to their learning styles. The positive relationship and lack of a pattern among students indicates that they have different learning styles and individual instructional needs.

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Title: 4MAT-TING the Big Six: Tailoring Research Assignment to Student Learning Style  
Author: Pickering-Thomas, Nancy; Wellins, Charlotte; and Vroegindewey, Dennis  
Publication: Paper presented at the American Association of School Librarians, 1997.  
Available from: Dr. Nancy Pickering Thomas e-mail, [thomasna@cadvantage.com](mailto:thomasna@cadvantage.com)  
Description: Too often students are asked to take an “all -about” approach in researching topics, which results in a minimal investment either in terms of personal interest or critical thinking. For the most part, such generic kinds of assignments amount to little more than fact-seeking missions, which, when they do not call on the student to create a point of view or apply what has been learned, tend to invite the “downloading” or copying of information found. In addition, such assignments assume a generic learner, because these types of projects are seldom structured in ways which acknowledge differences in learning styles or personal preferences. This paper presents an alternative approach to research project planning. Specifically, we employ the Big Six Skills model, developed by Eisenberg and Berkowitz (1990), as a framework for students in working through their research assignments and Bernice McCarthy’s 4MAT Learning System, which ensures that units are planned to tailor instruction and activities to match diverse learning styles. Embedding the Big Six within 4MAT can make students active participants by both creating projects which extend individual learning and presenting that learning to others. The Learning Style theory and the multiple intelligences theory provide frames for exploring alternative approaches to curricular themes and suggest ways which engage students in the creation of traditional and non-traditional research projects. Rubrics for the assessment of alternative projects are also presented.

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## Articles on 4MAT and Related Topics

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Title: Learning Styles. What Research Says to the Teacher Series.

Author: Reiff, Judith C.

Publication: *National Education Association*, Washington, D.C., 1992. p.42.

Available from: NEA Professional Library, P.O. Box 509, West Haven, CT 06516 (Stock No. 1092-2-00)

ISBN: 8106-1092-2

Description: This monograph reviews several approaches for describing learning styles and the instructional implications of an emphasis on learning styles for teachers. Several reasons for the importance of understanding individual learning styles are provided; such understanding leads to: (1) reduction of teacher and student frustration; (2) higher student achievement and an improved self-concept; (3) accommodation of a variety of learners in a classroom; (4) the versatility that is crucial to learning; and (5) improved communication with administrators, parents, counselors, and other staff. Cognitive, affective, and physiological learning styles are considered. Approaches for describing cognitive styles include brain theories, conceptual tempo, field dependence/field independence, mind styles, modalities, and multiple intelligences. Approaches for describing affective styles include conceptual systems theory and psychological types. Finally, approaches for describing physiological styles revolve around elements of learning styles which have been classified into four kinds of stimuli: environmental, emotional, sociological, and physical. Six approaches for classroom are provided. They are: (1) pedagogical intelligence; (2) Carol Hall's Living Classroom; (3) whole language; (4) Foxfire activities; (5) the 4MAT System; and (5) the DICSIE (Describe, Interact, Control, Select, Instruct, Evaluate) Model. It is concluded that teachers pass through several stages in their understanding of children's learning styles, and it is emphasized that administrative support, staff development, peer coaching, parent education, and personal determination and commitment are crucial in a positive learning styles classroom. A bibliography of 172 references is appended.

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Title: Impact of The 4MAT System as a Curriculum Delivery Model. Research Report.

Author: Sangster, Sandra; Shulman, Rhona

Publication: *North York Board of Education*, Willowdale (Ontario). Nov 1988

Description: A pilot project involving implementation and evaluation of the 4MAT curriculum system at secondary schools in Scarborough and North York (Ontario) is described. The 4MAT system is a curriculum delivery model developed by B. McCarthy that incorporates research by D. Kolb in the fields of learning styles and brain dominance. The model identifies four dominant learning styles, each assumed to be present in approximately 25% of the population. The model is graphically displayed as four quadrants with the axes representing two major functions that determine how each individual learns; specifically, the axes represent means of perceiving information (sensing and feeling versus thinking)

## Articles on 4MAT and Related Topics

and means of processing information (doing versus watching). The research performed for this study was designed to determine the effects of The 4MAT System on teachers' attitudes about differences in students' learning styles and students; and teachers' perceptions of the efficacy of the system. A total of 14 units of study based on the 4MAT Model were developed, and six were retained for use in this study. Teacher and student questionnaires and teacher follow-up interviews were used upon completion of the unit to determine curriculum effects on 31 teachers and 572 students involved in the study. Results indicate that the system was received well by both students and teachers. The 4MAT Research Project Teacher Interview Schedule, Teacher Survey, and Student Survey are included; and summaries of the responses are provided.

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Title: Learning Style Preferences among Older Adults  
Author: Truluck, Janet E. and Bradley C. Courtenay  
Publication: *Educational Gerontology*, 25, pp. 231-236, 1999  
Description: As more older adults are participating in learning activities, educators of this group are beginning to seek ways to improve learning among these individuals. Very little is known about the learning styles of older adults. This study attempted to determine the learning style preferences of older adults and the association of gender, age, and educational level to these preferences. D. A. Kolb's (1985) Learning Style Inventory was used to identify the preferred learning styles of 172 older adults from Northeast Georgia. Results found the older adults in this study fairly evenly distributed across the styles of Accommodator, Assimilator, and Diverger, with fewer preferring the Converger style, which involves thinking and doing while learning. Although no significant effects were found between learning style preferences and gender, age, or educational level, there were some age trends noted. It is suggested that not all older learners are active, hands on learners as adult education literature suggests, but rather with age there is a tendency to become more reflective and observational in the learning environment.

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Title: Planning Models: Two Alternatives to Hunter.  
Author: Van Cleaf, David  
Publication: *Educational Considerations*, Vol. 15, No. 2, pp. 13-15, Spring, 1988.  
Available from: College of Education, Kansas State University, Manhattan, KS 66505.  
Description: The author presents alternative learning models to Madeline Hunter's master learning model. They are (1) the Teach-Practice-Apply (TPA) model, which calls for active teacher involvement in each phase, and (2) The 4MAT System, which models learning as a combination of two dimensions—perception and processing of information—which explains different learning styles.

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## Articles on 4MAT and Related Topics

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Title: A Format for All Seasons  
Author: Walsh, Nancy  
Publication: *Forum*, Vol. 13, No. 2, pp. 38–42, May/June 1987.  
Available from: The Ontario Secondary School Teachers' Federation (OSSTF), Toronto, Ontario, Canada  
Description: An interview by Nancy Walsh, Modern Language Head of Northview Heights Secondary School, Toronto, highlighting successes and problems in teaching the use of 4MAT. McCarthy comments on the model's applicability to different subject areas and discusses the need for teachers to adapt 4MAT to their own needs and context.

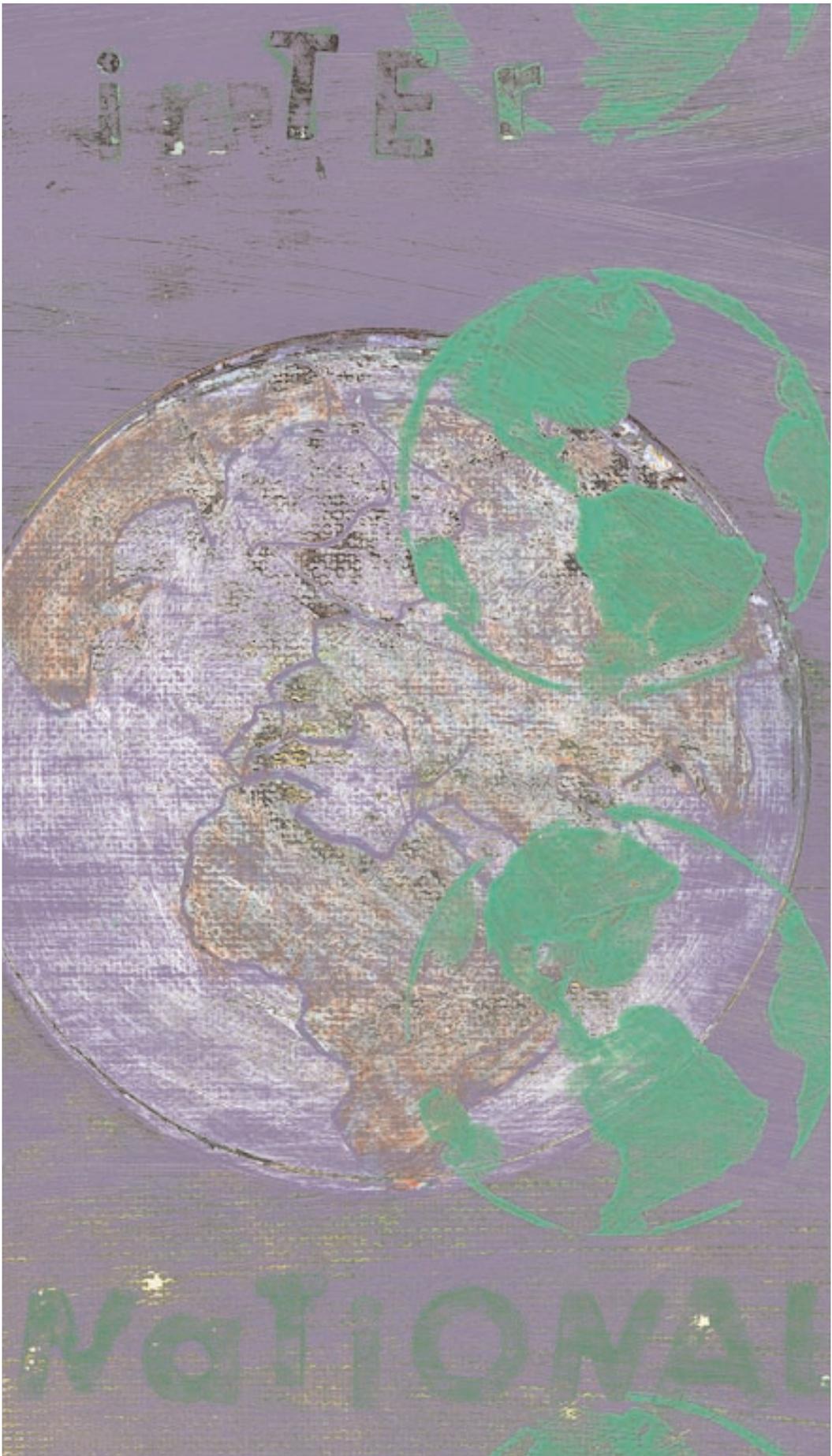
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Title: Using 4MAT to Improve Student Presentations.  
Author: Weber, Patricia; Weber, Fred  
Publication: *Educational Leadership*, Vol. 48, No. 2, pp. 41–46, Oct., 1990.  
Available from: UMI  
Description: When two upstate New York teachers analyzed the problems attending student presentations, it became clear that only students with Quadrant 2 (analytical) learning styles were comfortable listening to an oral report. After their gifted fifth and seventh graders created a 4MAT Wheel, their new insights helped generate possible solutions to common communication problems.

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Title: Not Everyone Learns Alike  
Author: Zettler, Penny  
Publication: *Leadership: A Practical Journal for Church Leaders*, Vol. VIII, No. 3, pp 28–33, Summer, 1987.  
Available from: Christianity Today Inc., Carol Stream, Illinois  
Description: A description of learning styles with an emphasis on Bernice McCarthy's 4MAT System. The author describes the learning styles differences delineated by McCarthy and gives concrete examples of how she teaches around the 4MAT cycle to all the styles of her learners. She makes a case for teachers to identify their own styles to better serve the needs of their students. She asks teachers to honor these legitimate differences by offering choices.

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## San Antonio

This study was designed to determine if differences exist in the academic performance and/or retention levels of students taught using The 4MAT Model when compared to students taught using a traditional or non-specified teaching methodology. As demonstrated by the data reported, the over-all performance of the 4MAT groups was superior to the performance of the non-4MAT control groups.

Especially noteworthy are comparisons of gain scores on a measure of academic performance in which three out of four 4MAT groups outperformed their non-4MAT cohorts.

Comparisons of retention scores, also strongly favor 4MAT classes. In four out of four paired comparisons the 4MAT group outperformed their Control counterparts. For two of the four comparisons, group one and group three, these differences were statistically significant. It is also noteworthy that in comparisons of academic gain group two outperformed the 4MAT group, yet for retention the 4MAT group slightly outperformed Control group two.

Using an analysis of covariance procedure to analyze gain score for a content measure these data are equally supportive of 4MAT effects. Three out of four comparisons of post-tests reveal that the 4MAT classes report higher raw and adjusted means than did their matched control classes.

On the covariant analysis of retention of a content measure results were equally demonstrative with three of the four 4MAT groups outperforming the control pairings, with group four showing statistically significant gains.

When comparisons of gain score (pre to post) are further defined using student performance on a standardized reading measure, comparisons by quartile consistently favor the 4MAT groups. Particularly noteworthy here is the performance of the first, or lowest, quartile. These students, often identified as “at risk,” show a gain of at least 50 points or more in three of the four 4MAT groups. Only groups one and three of the control groups had students scoring at or below the 25th percentile (quartile one) and of these only group three had a gain exceeding 50 points.

For overall comparisons by quartile, of the fourteen comparisons, eleven of the 4MAT groups achieved 50 points or higher, compared to eight of the Control.

The results of this study are particularly important in that the gains reported by the experimental /4MAT students were accomplished in classes that were equally, if not slightly more supported as demonstrated by student perceptions of social support reported in Table 8.

As evidenced by these data, and the data on quartile grouping in which a large number of the lower quartile populations were in the 4MAT groups ( see table 4) the 4MAT group performance would not be predicted.

This study clearly supports that as a tool for improving student performance, 4MAT appropriately implemented, can have striking effects upon student academics gain and retention.

*To obtain a copy of this complete study, please call About Learning, Inc. at 800-822-4MAT.*

## Paterson New Jersey

This study was also designed to determine if differences exist in the academic performance and/or retention levels of students taught using The 4MAT Model when compared to students taught using a traditional or non-specified teaching methodology. As demonstrated by the data reported, the over-all performance of the 4MAT pairings was superior to the performance of the non-4MAT control groups.

Especially noteworthy are comparisons of gain scores on a measure of academic performance in which six out of eight 4MAT groups significantly out performed their non-4MAT cohorts.

Using an analysis of covariance procedure these data are more striking. Eight out of eight comparisons of post-tests reveal that the 4MAT classes report higher raw and adjusted means than did their matched control classes. Five out of the eight post-tests comparisons were statistically significant in the direction of the 4MAT pairing.

In the analysis of retention scores, 4MAT classes had higher raw means in eight out of eight comparisons than control classes. In seven out of eight comparisons, 4MAT classes had higher adjusted means than control classes. Four out of the eight adjusted mean comparisons were statistically significant.

For retention of a content measure the results were less demonstrative with three of the 4MAT groups demonstrating significant gains. In the control population only one group showed a significant gain while two groups showed a negative gain in retention.

4MAT classes had higher raw means in eight out of eight comparisons than control classes. In seven out of eight comparisons, 4MAT classes had higher adjusted means than control classes. Four out of the eight adjusted mean comparisons were statistically significant.

The results of this study are particularly important in that the gains reported by the experimental /4MAT teachers were accomplished, not in a lab school setting, but in a school district which is, by most standards, very challenging. The fact that Paterson Public Schools, by mandate, have been taken over by the state of New Jersey in an effort to correct long-standing deficiencies speaks for itself. However, in spite of those deficiencies, this study demonstrates that teachers, adequately trained and supported can make a difference. This study also clearly supports that as a tool for improving student performance, 4MAT appropriately implemented, can have striking effects upon student academics gain and retention.

*To obtain a copy of this complete study, please call About Learning, Inc. at 800-822-4MAT.*

## Brain Studies

Research on hemispheric specialization and brain function support the following:

- The hemispheres of the human brain process information and experience in identifiably different ways.
- The neural organization in each hemisphere is complementary, yet different.
- The Corpus Callosum, the bundle of nerve fibers connecting the two hemispheres, serves to integrate the functions of the hemispheres.
- Hemispheric dispositions (preference) are identifiable.
- Individual preference for hemispheric integration has a supportable relationship to cognitive processing style, especially with regard to new learning.
- Brain research supports the belief that traditional education favors an all too narrow approach to teaching. Our “at-risk” students may be at risk due to our teaching methodologies rather than from any innate deficiencies of their own.
- Research on the effects of right and left mode instruction indicates that students differ with regard to hemispheric dominance, and that these differences influence student retention and performance.

Knowledge about the specialization of brain function has led to several hypotheses about how teaching and learning might be improved. In this regard, the guiding principle of the 4MAT Model is:

*“Meaningful teaching is teaching which systematically engages both hemispheres of the brain in problem-solving and understanding.”*

## Teachers and Teaching

It has been clearly demonstrated that parents’ education and income influence student performance in schools. These are variables which the schools cannot change. The research findings of teacher effects upon student learning, however, reveal the existence of several variables and conditions of learning which schools and teachers can act upon to have powerful effects upon student learning and performance. These are called “actionable variables.”

These variables illustrate:

- There are identifiable aspects of teaching and instruction which clearly influence student’s performance on academic tasks.
- A demonstrative relationship exists between specific teacher behaviors and successful student performance.
- Teacher sense of efficacy is significantly related to student achievement. This sense of personal power is not a fixed construct, but rather is negotiated daily and thrives in organizational structures with warm, accepting climates, climates where teachers work in teams and have decision-making power.
- Multiple methods of instruction connected to personal meaning, including strivings and self-discoveries, are related to higher levels of students’ performance and integrated learning.
- A classroom is an interactive environment within which every variable influences every other variable. Thus, in order to be successful, any effort at restructuring schools must give attention to the entire learning environment.

## Expert Learners

The nature of intelligence and the personal attributes of expert learners have long been subjects of inquiry for education researchers. And although similarities in metacognition exist as indicators of advanced thinking, specific applications for teaching continue to resist precise definitions. In the absence of validated application models, interpretations of research findings, particularly Resnick's composite on higher order thinking and the work of the Dreyfus brothers on "those who excel," hold promise for teachers and teaching.

According to Resnick, "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."

This assertion that higher order thinking skills are not hierarchical is revolutionary. This claim has a significant impact on pedagogy. For example, if classrooms, especially at elementary levels, cultivated these aspects of thinking into everyday teaching, it would be the basis of a new paradigm.

We believe that the following research-derived list of characteristics of expert learners illustrates clearly the cyclical nature of learning. Expert learners:

- Connect new experiences to past experiences thereby imposing personal meaning on what they learn
- Understand content at the conceptual level
- Reason by analogy to other similar situations
- Recognize past patterns and experiences and use gut reactions to respond
- Elaborate and reconstruct problems into new forms
- Search for consistencies and inconsistencies in proposed solutions
- Test implications of initial ideas and make modifications
- Use new learning creatively in actual life
- Move from subjectivity (what one senses and feels)...to objectivity (what the experts know and what one analyzes things to be)...to integration (what one adapts and incorporates into one's life)

## Change and Restructuring

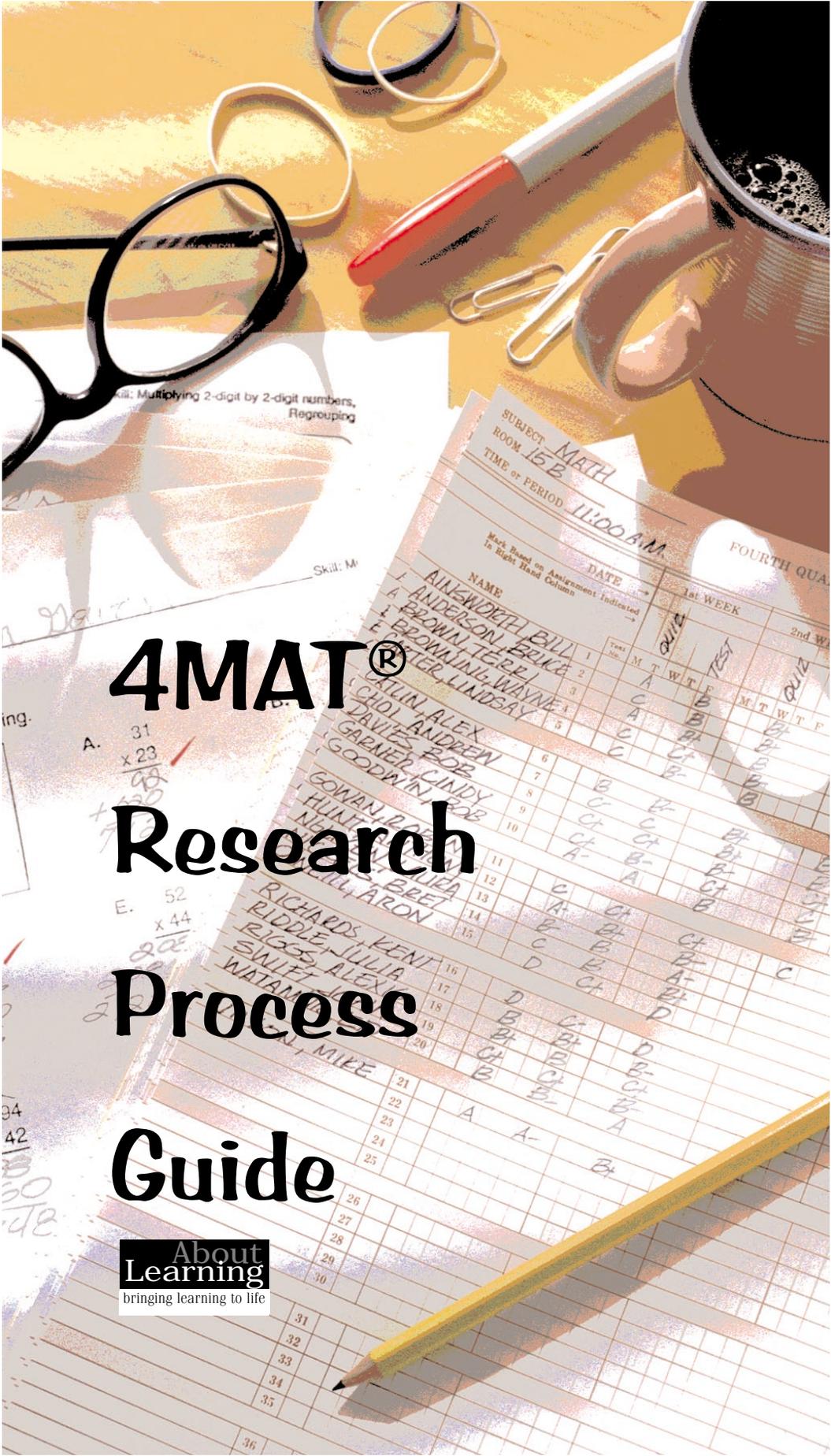
4MAT, a model for organizing and actualizing change processes in schools, is particularly useful in the creation of a culture of educational effectiveness. 4MAT methods and objectives, consistent with the research data cited below, are intended to change a school by changing the behaviors of the people vital to that school, beginning with its teachers. 4MAT also provides an organizational framework for dealing with a system: from building community and morale, to creating structures that are consistent with the school's mission, to managing operations and finding the resources to accomplish that mission and finally to building a dynamic culture through continuous evaluating and refocusing.

After only two decades of serious research on change processes in schools, several pointed findings emerge. These findings, which form the basis of this restructuring design, include the following:

- Change projects in schools can be successful. There exists a strong base of evidence about how and why educational reform fails or succeeds, a specific set of research-derived Do's and Don'ts.

## Research Summary

- The creation of an open, trusting climate and better relationships must be the beginning of any successful system change.
- Organization structure, operational procedures, and evaluation techniques must be congruent with the stated mission and values of the school.
- Positive educational change begins with teachers. Without their willing participation, change efforts usually fail.
- Adult learners become meaningfully involved when recognized and given increased responsibility.
- Successful change involves changing the culture of the organization.



# 4MAT<sup>®</sup> Research Process Guide

About Learning  
bringing learning to life

## Theoretical Assumptions About 4MAT

### Learning Types

Individuals learn in different yet identifiable ways

These individual learning preferences, although clearly not related to aptitude, are significantly related to personal motivation and performance

Motivation and academic performance improve as individuals identify and use their natural learning style as well as practice and accommodate less preferred strategies.

### Hemisphericity

Individuals have at their disposal two complementary methods for approaching and representing information and experience.

Adequate engagement of both methods, described in the literature as right and left hemispheric processing, results in deepened levels of personal understanding.

Engagement across the two-hemisphere continuum usually defined as “whole brain” learning has serious implications for designing instruction and understanding human learning.

### Teaching

A demonstrable relationship exists between specific teacher behaviors and student performance.

Learning and transfer are more appropriately encouraged when classroom events systematically incorporate attention to personal experience, reflection, conceptualization, practice, extension, refinement and integration using right and left hemispheric representations.

Multiple methods of instruction connected to personal meaning, including striving and self-discovery, are related to higher levels of student performance.

4MAT is a practical pedagogy for teaching to “wholeness”, encouraging creativity and accounting for human diversity.

# 4MAT Research Process Guide

*Leadership is about learning that leads to constructive change*

–Lambert, 1998

As with most aspects of education, accountability is a key word in a 4MAT Implementation Project. Providing documentation and evaluation of a 4MAT Project returns to a school community, district, or grantor important information about the progress and the effectiveness of the program and suggests directions for future planning.

Many people perceive the research process as more difficult than it needs to be. Each implementation is unique and each study will reflect the specific goals, issues, and applications of those involved in the project. However, there is a common context to educational research that sets the stage:

- for identifying useful questions;
- for generating effective information gathering, analysis, and dissemination; and
- for ensuring greater validity and reliability to the process and to its results.

The first step is to gather together those planning the 4MAT Implementation. Your discussions begin with these four questions from around the wheel.

**1. Why is this research necessary?**

**2. What do we believe we can demonstrate about the impact of our project?**

**3. How is the research design organized?**

**4. If we are successful, who will benefit from our study?**

## Building a Framework for a Research Study

### 1. Why is this research necessary?

The initial discussion establishes a common vision to solidify **reasons** for the research study and to determine its **purposes**. This is an authentic discussion about what you believe and why you think 4MAT will help you reach your goals.

Remember that good evaluation is:

- designed as a collaboration
- aligned with goals and missions
- focused on short- and long-term targets
- measured with a variety of evidence over time
- used to determine processes, relationships, and outcomes

To help identify your specific purposes for the research study, you might begin the discussion with these sentence starters:

Excellence is...

4MAT can help us...

A good classroom is...

A good learner is...

We can further meet our mission by...

### **2. What do we believe we can demonstrate about the impact of our 4MAT project?**

Once you have clarified the reasons for and the purposes of the 4MAT implementation study, it is time to determine the specific **questions** that will demonstrate the impact of your program.

#### **Will the questions target the teacher's:**

- Sense of professional efficacy?
- Attitude toward particular learner groups?
- Attitude toward the process of teaching?
- Knowledge of the process of teaching?
- Planning and instructional delivery?
- Application of the 4MAT model?
- Other?

#### **Will the questions target the students':**

- Sense of personal efficacy?
- Attitude toward school?
- Attitude toward learning?
- Attitude toward peers?
- Attendance?
- Retention rate?
- Classroom behavior?
- Cooperation with peers and instructors?
- Creativity?
- Achievement on specific content measures?
- Other?

### **Will the questions target the school's or program's:**

Achievement on standardized measures?

Reduction in discipline referrals?

Reduction in Special Education referrals?

Reduction in numbers of Limited English Proficient speakers?

School climate?

Expectations for students?

Curriculum and instruction?

Induction and professional development projects?

Assessment?

Parent and community relationships?

Other?

Each question should help you to track the needs identified in your answers to Question 1. They should be framed with specificity to:

- Document the effectiveness of a particular process
- Show relationships of an intervention to a result
- Chart trends and outcomes

Questions should be meaningful, with a specific focus, and be answerable!  
Choosing appropriate questions is the key step to successful research design.

### 3. How is the research design organized?

In its initial discussion, the planning group examined the reasons for the study and the purposes of the study. Your conversation provided the “why” of the project. As a group, you generated the research questions tied to your purposes. These questions determine the kinds of **data**, or information, you wish to gather. Are you looking to explore the effectiveness of a process? To show the relationships of process to particular outcomes? Or to chart change?

The **research design** creates a systematic inquiry to answer the particular questions you have posed to determine the effectiveness of your 4MAT Implementation. Surveys, interview protocols, standardized test scores and observation records are some of the many instruments available to document the information you are gathering.

Your instrumentation choices will be the sources used to collect the data to show evidence of progress in answering the original questions. These choices lead to the “what” and “how” of the research design.

### 4. If we are successful, who will benefit from our study?

This answer should lead right back to the responses generated in Question 1. The most critical communication of the findings and conclusions is to that of the participants and the school or program's natural audiences: administration, faculty and staff members, students, parents, grant funders, and broader community members. Planning should begin early on how regular progress reports and summative documentation will be shared.

In addition, contribute to the growing 4MAT network of practitioners. Consider the following venues for dissemination of the results of the 4MAT Implementation Study:

#### **Educational Community**

- Regional, national, and international conferences

- Site-based seminars

- Lectures for local organizations

- Features in local media

- Biennial 4MAT Renewal Conference

# 4MAT Research Process Guide

## Professional Journals

Educational Leadership

Kappan

Teacher

Discipline based journals

## Electronic Journals and Data Bases

Education and Research Information Clearinghouse,  
[www.ed.gov/EdRes/EdRed/ERIC.html](http://www.ed.gov/EdRes/EdRed/ERIC.html)

About Learning, [www.aboutlearning.com](http://www.aboutlearning.com)

Practical Assessment, Research & Evaluation, [www.ericae.net/pare/](http://www.ericae.net/pare/)

4MATION® LiveText

## Referred Journals

*Teachers College Record*

*Educational Evaluation and Policy Analysis*

*American Educational Research Journal*

*Education and Urban Society*

*Educational Researcher*

*Educational Administration Quarterly*

*The Elementary School Journal*

*The 4MAT Research Guide*--Available as Synopsis, Book, or CD

*4MAT The Original Comprehensive School Reform Model*

About Learning, Inc. website for theoretical overview, products, services, and bibliography: [www.aboutlearning.com](http://www.aboutlearning.com)

Statistical Analyses: Service references upon request

Please direct additional inquiries to:

Linda Lippitt, Ph.D.

Director, Research Division

About Learning, Inc. Research Line:

[linda@aboutlearning.com](mailto:linda@aboutlearning.com) or 505-820-7143

## Instrumentation

The sample instruments provided in the full 4MAT Research Process Guide may be reproduced as customized research instruments.

Theoretical Assumptions About 4MAT®,  
p. 22-23

**SAMPLE A**  
Evaluation Designs, p.24-26

**SAMPLE B**  
Developing a Needs Assessment, p. 28  
Pre-Assessment Data Survey, p. 29  
Needs Assessment Worksheet, p. 31

**SAMPLE C**  
Teacher Participant Survey, p. 33-34

**SAMPLE C**  
Qualitative Exit Instrument  
Level 1: Foundations, Day One, p. 35

**SAMPLE D**  
Principles of 4MAT Questionnaire  
Level 1: Foundations, Day Three, p. 37-38  
Principles of 4MAT Questionnaire Answer  
Key, p. 39

**SAMPLE E**  
4MAT Level 2: Applications  
1 The Concept of Concepts, p. 41-42  
2 The Natural Cycle, p. 43-44  
3 The Brain: Direct Classroom  
Applications, p. 45-46  
4 Infusing Standards: Managing  
Content Coverage, p. 47-48  
5 4MAT and Assessment, p. 49-50  
6 The Final Unit: Pulling It All  
Together, p. 51-52  
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**SAMPLE F**  
Field Test Reaction Sheets  
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Teacher Survey, p. 57-58  
Teacher Reflections, p. 59-60  
4MAT and Teacher Standards, p. 61  
Final Teacher Reflections, p. 63  
Parent Survey, p. 65-66  
Student Survey, p. 67-68  
Student Reaction Sheet, p. 69

**SAMPLE G**  
Data Analysis Chart, p. 71  
Student Impact Survey, p. 73

**4MAT® Research Process Guide**  
Pre-Assessment Data Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

What is your current assessment strategy for the research process?

1. I use a variety of assessment strategies to assess my students' understanding of the research process.  
2. I use a variety of assessment strategies to assess my students' understanding of the research process.  
3. I use a variety of assessment strategies to assess my students' understanding of the research process.  
4. I use a variety of assessment strategies to assess my students' understanding of the research process.  
5. I use a variety of assessment strategies to assess my students' understanding of the research process.

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p 29 Pre-Assessment Data Survey

**4MAT® Research Process Guide**  
Rank Assessment Worksheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Question 2. Measure 3. Responsibility 4. Details

31

p 31 Needs Assessment Worksheet

**4MAT® Research Process Guide**  
4MAT Implementation Study Teacher Development Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Thank you for participating in this project.

1. How do you feel about the 4MAT process?  
2. How do you feel about the 4MAT process?  
3. How do you feel about the 4MAT process?  
4. How do you feel about the 4MAT process?  
5. How do you feel about the 4MAT process?

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p 33 Teacher Participant Survey

**4MAT® Research Process Guide**  
Qualitative Exit Survey Level 1 Evaluation

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How is what I feel was important to me being?

1. I have been very understanding and open.  
2. I have been very understanding and open.  
3. I have been very understanding and open.  
4. I have been very understanding and open.  
5. I have been very understanding and open.

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p 35 Exit Survey, Level 1, Day 1

**4MAT® Research Process Guide**  
Principles of 4MAT Assessment

Name: \_\_\_\_\_ Date: \_\_\_\_\_

What is the purpose of the 4MAT assessment?

1. To assess the student's understanding of the research process.  
2. To assess the student's understanding of the research process.  
3. To assess the student's understanding of the research process.  
4. To assess the student's understanding of the research process.  
5. To assess the student's understanding of the research process.

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p 37 Principles of 4MAT

**4MAT® Research Process Guide**  
Implementation Reflection: The Concept of Concepts

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 41 Level 2: Concept of Concepts

**4MAT® Research Process Guide**  
Implementation Reflection: The Natural Cycle

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Question 2. Measure 3. Responsibility 4. Details

43

p 43 Level 2 Natural Cycle

**4MAT® Research Process Guide**  
Implementation Reflection: The Brain

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 45 Level 2: The Brain

**4MAT® Research Process Guide**  
Implementation Reflection: Learning Standards

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

47

p 47 Level 2: Infusing Standards

**4MAT® Research Process Guide**  
Implementation Reflection: 4MAT Assessment

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 49 Level 2: 4MAT & Assessment

**4MAT® Research Process Guide**  
Implementation Reflection: The Final Unit

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 51 Level 2: Final Unit

**4MAT® Research Process Guide**  
4MAT Key for Implementation Reflections

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Question 2. Measure 3. Responsibility 4. Details

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p 53 Level 2 Answer Key

**4MAT® Research Process Guide**  
4MAT Implementation Study Final Unit Reaction Sheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 55 Unit Reaction Sheet

**4MAT® Research Process Guide**  
Final Unit Teacher Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 57 Unit Teacher Survey

**4MAT® Research Process Guide**  
4MAT Project Teacher Reflections

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 59 4MAT Project Teacher Reflections

**4MAT® Research Process Guide**  
4MAT Teacher Standards

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 61 4MAT & Teacher Standards

**4MAT® Research Process Guide**  
4MAT Teacher Reflections

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 63 Teacher Reflections

**4MAT® Research Process Guide**  
4MAT Parent Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 65 Parent Survey

**4MAT® Research Process Guide**  
4MAT Student Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 67 Student Survey

**4MAT® Research Process Guide**  
4MAT Student Reaction Sheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Question 2. Measure 3. Responsibility 4. Details

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p 69 Student Reaction Sheet

**4MAT® Research Process Guide**  
4MAT Data Analysis Chart

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 71 Data Analysis Chart

**4MAT® Research Process Guide**  
4MAT Student Impact Survey

Name: \_\_\_\_\_ Date: \_\_\_\_\_

How did you feel about the 4MAT process?

1. I was very understanding and open.  
2. I was very understanding and open.  
3. I was very understanding and open.  
4. I was very understanding and open.  
5. I was very understanding and open.

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p 73 Student Impact Survey



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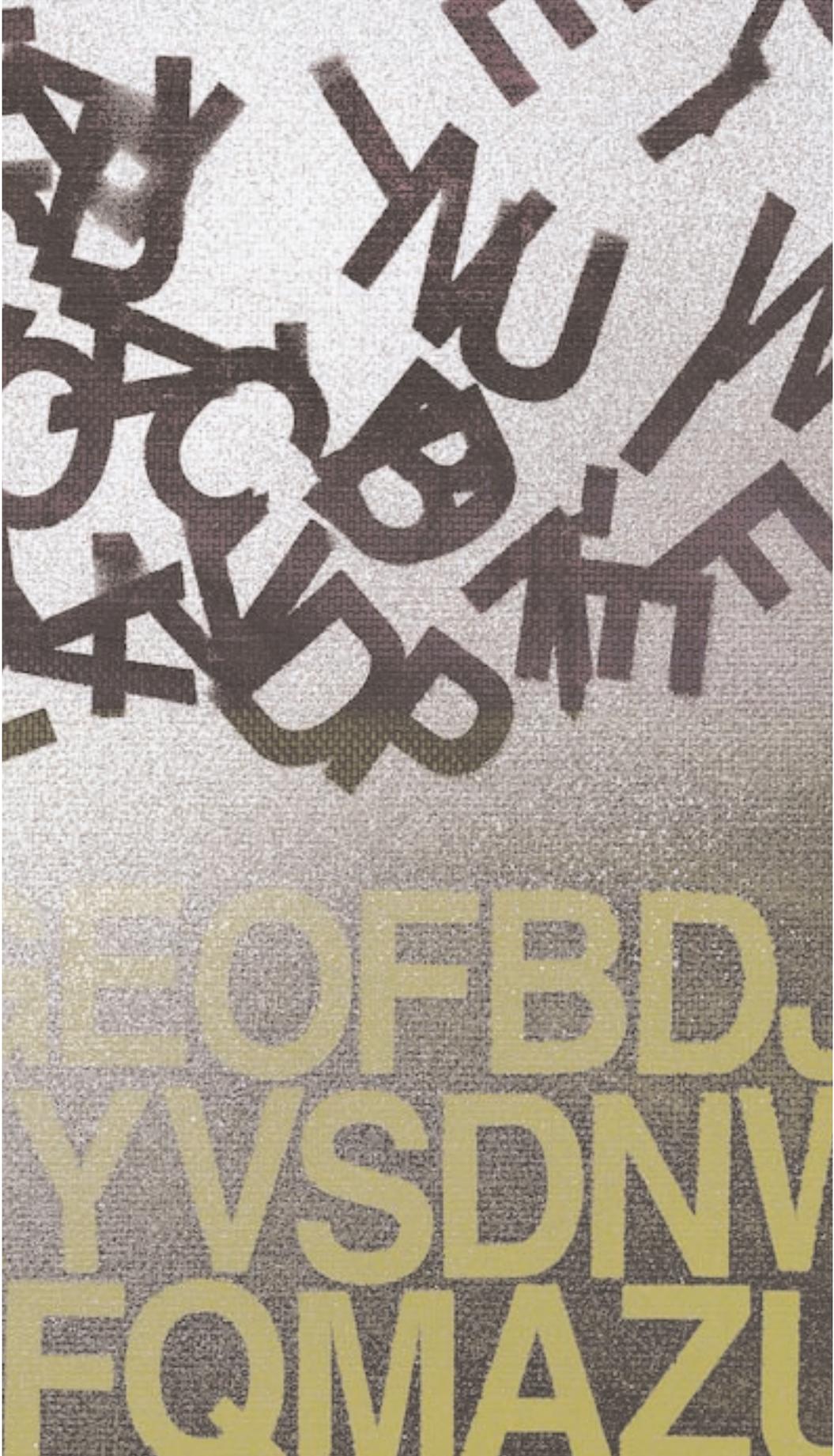
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# Appendices

## Learning Type Measure® Manual

Participants should share their HMI scores and post on their paper chart the range of Right Mode, Left Mode, and Whole-Brained participants for their learning style group (Ones, Twos, Threes, and/or Fours).

**Note:** Again, if you use the LTM without overlaying the HMI score, then confine your discussion and the groups' discussions to the four quadrant results coupled with the watching/doing results. These two dimensions are important insights in their own right.

### Technical Documentation

#### *Introduction*

The results reported in this technical manual are based on the Learning Type Measures (LTM) administered to 390 people attending workshops on 4MAT, a teaching method based on people's different learning styles or types.

The measure described here reflects the four learning types of Dr. Bernice McCarthy, the author of 4MAT.

Part A contains 15 items with four stems each. Respondents are asked to rank each stem from 4 (most like you) to 1 (least like you). The stems have been keyed to represent each learning type.

Part B contains 11 items with two choices each. The choices represent "Doers" or "Watchers." Respondents are asked to choose one of the two choices that is most like themselves. Here, too, a key is provided for each choice as being indicative of a "Doer" or a "Watcher."

#### *Validity*

The stems in the 15 items of Part A represent the descriptions of the four types of learners found in several books and articles by Dr. McCarthy and her colleagues. Therefore, the measure has content validity, since the items represent those four styles. Similarly for the items in Part B, these choices represent learning types activities, i.e., doing or watching.

There are three demonstrations we wish to present to support the claim that the LTM has construct validity. First, do people have a learning Type, i.e., there is one type that is distinguishable from the rest?

To answer this question, we score the LTM in the following way: A key is provided for the respondent to score his or her own test. Respondents add up the ratings for the stems representing one type, then do the same thing for each of the remaining three types. Of the four sums calculated, the maximum represents the respondent's learning type. All four learning types are represented in this sample as shown in Table 1 (next page).

# Appendices

**Table 1 Frequency Distribution of Learning Types**

Type	Count	Percent
Ones	167	42.8
Twos	55	14.1
Threes	78	20.0
Fours	80	20.5
No Single Type	10	2.6
Total	390	100.0

Only 10 people of the 390 had a tie between two sums. For teaching or understanding oneself, even this more complex information is meaningful according to Dr. McCarthy's theory.

The second question concerned with Construct Validity is: Do people have sharply peaked profiles or are the sums across the four types nearly the same? The maximum sum is 60 (4 ratings on all 15 items in the same type) and the minimum is 15 (1 ratings on all 15 items in the same type). To test the hypothesis of peakedness, we calculated the difference between the maximum sum and the next highest sum. The results are displayed in Table 2 on the next page.

## Appendices

**Table 2 Difference Between the Maximum and the Next Highest Sum**

Difference	Count	Percent
0	10	2.6
1	35	9.0
2	22	5.6
3	25	6.4
4	23	5.9
5	27	6.9
6	26	6.7
7	30	7.7
8	13	3.3
9	24	6.2
10	18	4.6
11	10	2.6
12	20	5.1
13	16	4.1
14	11	2.8
15	14	3.6
16	13	3.3
17	11	2.8
18	5	1.3
19	9	2.3
20	11	2.8
21	4	1.0
22	5	1.3
23	5	1.3
25	3	0.8
Total	390	100.0

70% of the respondents had differences between their maximum sum and their next highest sum of 5 or more. 50% had differences of 7 or more. Differences ranged from 0 (for the ten who had two identical sums) to 25 (a very peaked profile).

A final question concerning construct validity focuses on the “correct” respondents rating a particular stem strongly, i.e., 3 or 4. Table 3 shows the result of this analysis.

# Appendices

**Table 3 Analysis of Each Stem in Part A**

Stem	Key	Proportion of “Key People” Rating the Stem		Stem	Key	Proportion of “Key People” Rating the Stem	
		4	3 or 4			4	3 or 4
1a	2	63.6	83.6	8a	4	66.3	86.3
1b	1	54.5	84.4	8b	1	68.9	91.7
1c	3	75.6	92.3	8c	3	37.2	76.9
1d	4	65.0	88.8	8d	2	67.3	87.3
2a	1	65.3	82.1	9a	3	56.4	89.7
2b	2	63.6	89.1	9b	4	63.8	85.1
2c	3	59.0	84.6	9c	1	43.1	65.3
2d	4	62.5	91.3	9d	2	69.1	92.7
3a	3	65.4	96.2	10a	4	61.3	80.1
3b	2	40.0	63.6	10b	2	58.2	70.9
3c	4	41.3	75.1	10c	3	41.0	67.9
3d	1	69.5	94.1	10d	1	48.5	84.4
4a	4	31.3	66.3	11a	4	57.5	88.8
4b	2	72.7	89.1	11b	2	41.8	83.6
4c	1	56.3	79.7	11c	1	46.1	73.0
4d	3	35.9	66.7	11d	3	51.3	87.2
5a	1	73.1	88.7	12a	1	75.4	92.2
5b	4	57.5	82.5	12b	2	56.4	89.1
5c	3	32.1	78.3	12c	3	41.0	65.4
5d	2	50.9	78.2	12d	4	33.8	62.6
6a	2	67.3	81.8	13a	3	37.2	69.3
6b	4	67.5	86.3	13b	2	43.6	74.5
6c	3	44.9	90.8	13c	1	35.9	68.2
6d	1	49.7	79.0	13d	4	67.5	82.5
7a	3	55.1	83.3	14a	1	78.4	91.6
7b	1	70.1	82.7	14b	2	45.5	71.0
7c	4	58.8	83.8	14c	3	28.2	66.7
7d	2	49.1	70.9	14d	4	50.0	83.8
			15a	1	55.7	79.7	
			15b	2	43.6	72.7	
			15c	3	44.9	73.1	
			15d	4	83.8	98.8	

# Appendices

## Reliability

There are two forms of reliability to be presented here. The first is internal consistency, measured by the Cronbach alpha statistic, which has a range from 0 to 1. Items which form a uni-dimensional scale, i.e., which all measure the underlying dimension represented by the total score have a high alpha and items which measure several different dimensions have a low value for alpha. Achievement tests typically have an alpha of between 0.80 and 0.90. Attitude or affective inventories have alphas between 0.70 and 0.90. The alpha values for the four sets of items forming the four learning type sums in Part A and the do vs. watch items in Part B are shown in Table 4.

**Table 4 Internal Consistency of Item Scales**

Scale	Cronbach Alpha
<b>Part A:</b>	
Learning Type One	0.853
Learning Type Two	0.835
Learning Type Three	0.767
Learning Type Four	0.885
<b>Part B:</b>	
Do vs. Watch	0.863

The second form of reliability is test-retest. This statistic, the correlation between two administrations of the same measure, yields an estimate of stability of the measure. The test-retest reliability coefficient, because it is indicative of the consistency of scores over time, is also referred to as a coefficient of stability. Analysis of the LTM yields a .71 test-retest coefficient. Reliability is in part a function of the nature of the variable being measured and since all self-report measures of human qualities are expected to contain some degree of error, a .71 test-retest coefficient is an indicator of a high level of stability.

## Concurrent Validity

Concurrent validity is the relationship between two simultaneous but independent judgments on the same trait or ability. Here, to establish concurrent validity for the Learning Type Measure (LTM), we compare LTM scores with two other measures describing types, the Learning Style Inventory (LSI), and the Myers Briggs Type Indicator (MBTI).

# Appendices

## The Relationship Between LTM and LSI

175 persons completed both the LTM and the LSI. It would not be proper to correlate the four sum scores produced by the LTM with the four scores produced by the LSI, for the following reasons. In the LSI, differences are calculated and a point is plotted based on the coordinates determined by those differences. In the LTM the highest sum score determines the learning type.

Instead, we will test the relationship between the LTM and the LSI using a contingency table analysis and determine the strength of the relationship of the two constructs using relevant statistics.

Count Row Pct Col Pct	L Type				Row Total
	1.00	2.00	3.00	4.00	
1.00	44.0			2.0	46.0
	95.7			4.3	26.3
	51.8			6.3	
2.00	22.0	26.0	6.0	5.0	49.0
	37.3	44.1	10.2	8.5	33.7
	25.9	81.3	23.1	15.6	
3.00	5.0	5.0	15.0	3.0	28.0
	17.9	17.9	53.6	10.7	16.0
	5.9	15.6	57.7	9.4	
4.00	14.0	1.0	5.0	22.0	42.0
	33.3	2.4	11.9	52.4	24.0
	16.3	3.1	19.2	68.8	
<b>Column Total</b>	85.0	32.0	25.0	32.0	42.0
	48.6	18.3	14.9	18.3	24.0

<u>Chi-Square</u>	<u>D.F.</u>	<u>Significance</u>
137.42826	9	p < .0001
<u>Statistic</u>	<u>Value</u>	
Cramer's V	.51163	
Contingency Coefficient	.66323	

There is a 61.1% agreement between the two measures (107/175). The chi-square test, Cramer's V and the Contingency Coefficient all show a significant relationship between the LSI and the LTM as well.

# Appendices

## The Relationship Between the LTM and the MBTI

### Legend

		<b>SUM 1</b>	<b>SUM 2</b>	<b>SUM 3</b>	<b>SUM 4</b>
<b>E</b>	<i>Correlation</i>	.1933	-.4027	-.3492	.4569
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .073	P = .001	P = .004	P = .000
<b>S</b>	<i>Correlation</i>	.0395	.2553	.5013	-.6123
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .384	P = .027	P = .000	P = .000
<b>T</b>	<i>Correlation</i>	.6588	.6164	.4777	-.3626
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .000	P = .000	P = .000	P = .003
<b>J</b>	<i>Correlation</i>	-.2138	.6804	.3242	-.6774
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .054	P = .000	P = .007	P = .000
<b>I</b>	<i>Correlation</i>	-.2458	.4769	.4261	-.5384
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .031	P = .000	P = .000	P = .000
<b>N</b>	<i>Correlation</i>	-.0293	-.1706	-.5481	.5605
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .413	P = .100	P = .000	P = .000
<b>F</b>	<i>Correlation</i>	.6519	-.5800	-.4778	.3421
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .000	P = .000	P = .000	P = .004
<b>P</b>	<i>Correlation</i>	.2209	-.6834	-.3489	.6920
	<i>Count</i>	( 58)	( 58)	( 58)	( 58)
	<i>Significance</i>	P = .048	P = .000	P = .004	P = .000

Significant relationships between the LTM and the MBTI are as follows:

The F, or Feeling score is most associated with the Learning Type 1 score.

The I, Introvert, T, Thinking, and J, Judging scores are most associated with the Learning Type 2 score.

The S, Sensing score, is most associated with the Learning Type 3 score.

The E, extrovert, N, Intuitive, and P, Perceiving scores are most associated with the Learning Type 4 score.

# Appendices

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## Hemispheric Mode Indicator Manual

### SECTION A: TECHNICAL NOTES FOR THE HMI

#### Content Validity

From a review of the literature in the area of brain hemisphere dominance (see Bibliography), forty items were prepared which reflected themes that the various authors had attributed to right or left hemisphere laterality. They reflect a range of dimensions of thought, behavior and feelings.

An empirical test of the left/right scoring of each question was performed on the original items by correlating each item with the total test score, corrected by removing that item's score from the total. Thirty-two items produced responses that corresponded to the expected direction of scoring. Those 32 items were tested in further analyses.

#### Concurrent Validity

Total scores from the 32 item test were correlated with the Torrance measure, (SOLAT-C) Your Style of Learning and Thinking, Form C. Forty-nine subjects took both measures during a workshop on learning styles and hemispheric laterality. For those subjects, the Spearman rank correlation coefficient was 0.819. (The Pearson Product-moment correlation is 0.659.) These results show the HMI measure to be similar to the Torrance measure, but not identical or measuring something completely different.

#### Reliability (Internal Consistency)

Items were rescored so that high negative scores are related to a left hemisphere mode and high positive scores are related to a right hemispheric mode. Choices were coded in the following manner.

Left Mode Choices:	A lot like you	-2
	Somewhat like you	-1
Right Mode Choices:	A lot like you	+1
	Somewhat like you	+2

A score of zero might be interpreted two ways, no preference or equal preferences to each mode. A frequency distribution of the 76 subjects who took the HMI showed consistent clustering near the center or to one side rather than a U-shaped curve.

Cronbach's alpha was calculated for the 76 subjects' responses resulting in a coefficient of 0.90.

Correlations between each item score and the total test score are given in Table 1. The total score is corrected by removing each item considered, and left-brain item scores were reversed so that all item scores were positive.

# Appendices

## Reliability (Test-Retest!)

A sample of 47 subjects were administered the HMI twice, approximately two months apart. The Pearson Product Moment Correlation coefficient between the two testings was 0.904.

*Table 1: Item-Total Correlations \Corrected)*

ITEM	CORRELATION	ITEM	CORRELATION	ITEM	CORRELATION	ITEM	CORRELATION
1	0.663	9	0.159	17	0.577	25	0.526
2	0.575	10	0.416	18	0.433	26	0.291
3	0.484	11	0.433	19	0.441	27	0.268
4	0.268	12	0.377	20	0.439	28	0.392
5	0.643	13	0.424	21	0.415	29	0.465
6	0.515	14	0.216	22	0.484	30	0.608
7	0.425	15	0.596	23	0.539	31	0.373
8	0.311	16	0.468	24	0.541	32	0.276

## Section B: Norms for the HMI

### Introduction

Approximately 2000 educators completed the Learning Style Inventory (LSI) and the Hemispheric Modality Indicator (HMI). The largest proportion were teachers and a few were administrators. Respondents also indicated their age and sex.

The following analyses are an attempt to provide users or potential users with some norms for comparison with local or regional data.

### Results

Table 1 shows the distribution of learning styles for respondents whose four subscores totaled 120. Almost one-quarter of the respondents' totals were not correct and therefore the subscores could not be considered accurate, either. (The subscores are needed to calculate the learning style.) The most noteworthy point is the paucity of Three's. In other studies involving elementary teachers, there were less Two's than in this general population. (NOTE: Perhaps proportionally more Two's can add correctly?)

Tables 2A and 2B break down the LSI scores by age. The counts and row percentages are displayed in the two tables, respectively. Table 2B specifically shows very similar distributions of learning styles of each age and a test of significance showed no relationship between the two.

The relationship between learning style and sex is shown in Tables 3A, 3B and 3C. In the responding population there were almost exactly twice as many women as men. Table 3B shows females disproportionately higher in styles One and Four and lower in Two and Three. Among males, the largest proportion were Two's and among females, Fours. There was a statistically significant relationship between learning style and sex (Chi-Square = 54.6,  $p < .001$ ).

A frequency distribution of HMI scores is shown in Table 4A. A graph of these frequencies is given in Figure 1. The shape of the distribution is approximately normal except for large drops between -2 and -10, and +2 and +10. This supports the proposed category boundaries used in the next few tables.

The distribution of HMI scores by predefined categories is shown in Table 4B. Left hemisphere and right hemisphere dominated respondents represent almost three quarters of the sample.

Tables 5A, 5B and 5C show the distribution of HMI scores by sex. Tables 5B and 5C indicate males being over represented in the left dominance and females in the right. There is a statistically significant relationship between HMI and sex. (Chi-Square= 42.18,  $p < .001$ ).

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The relationship between learning style and hemispheric dominance is given in Tables 6A, 6B and 6C. Both tables 6B and 6C show the Twos are disproportionately left-hemisphere dominant and Fours are disproportionately right-hemisphere dominant. There is a statistically significance relationship between HMI and learning style (ChiSquare = 373.1, p,.001).

Table 1: Distribution of Learning Styles

	N	PERCENT
ONE	331	21.9
TWO	491	32.5
THREE	281	18.6
FOUR	410	27.1
TOTAL	1513	100.0

Table 2A: Learning Style by Age (Counts)

AGE	ONE	TWO	THREE	FOUR	TOTAL
21-25	11	28	10	27	76
26-30	35	44	27	45	151
31-35	64	75	44	53	236
36-40	69	109	61	97	336
41-45	44	72	46	63	225
46-50	34	50	35	43	162
51-55	24	30	16	29	99
56-60	15	18	8	11	52
61-65	5	4	5	6	20
66-80	1	0	1	1	3
<b>TOTALS</b>	<b>302</b>	<b>430</b>	<b>253</b>	<b>375</b>	<b>1360</b>

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*Table 2B: Learning Style by Age (Percent)*

AGE	ONE	TWO	THREE	FOUR	TOTAL
21-25	14.5	36.8	13.2	35.5	5.6
26-30	23.2	29.1	17.9	29.8	11.1
31-35	27.1	31.8	18.6	22.5	17.4
36-40	20.5	32.4	18.2	28.9	24.7
41-45	19.6	32.0	20.4	28.0	16.5
46-50	21.0	30.9	21.6	26.5	11.9
51-55	24.2	30.3	16.2	29.3	7.3
56-60	28.8	34.6	15.4	21.2	3.8
61-65	25.0	20.0	25.0	30.0	1.5
66-80	33.3	0.0	33.3	33.3	0.2
<b>TOTALS</b>	<b>22.2</b>	<b>31.6</b>	<b>18.6</b>	<b>27.6</b>	

*Table 3A: Learning Style by Sex (Counts)*

	MALE	FEMALE	
ONE	92	232	324
TWO	189	280	469
THREE	124	147	271
FOUR	89	312	401
<b>TOTALS</b>	<b>494</b>	<b>971</b>	<b>1465</b>

*Table 3B: Learning Style by Sex (Row Percentage)*

	MALE	FEMALE	
ONE	28.4	71.6	100.0
TWO	40.3	59.7	100.0
THREE	45.8	54.2	100.0
FOUR	22.2	77.8	100.0
<b>TOTALS</b>	<b>33.7</b>	<b>66.3</b>	

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Table 3C: Learning Styles by Sex (Column Percentages)

	MALE	FEMALE	
ONE	18.6	23.9	22.1
TWO	38.3	28.8	32.0
THREE	25.1	15.1	18.5
FOUR	18.0	32.1	27.4
<b>TOTALS</b>	<b>100.0</b>	<b>100.0</b>	

Table 4A: HMI (Distribution—4 Point Interval)

HMI	N	HMI	N
-62 to -59	0	3 to 6	99
-58 to -55	1	7 to 10	67
-54 to -51	4	11 to 14	88
-50 to -47	14	15 to 18	63
-46 to -43	15	19 to 22	68
-42 to -39	30	23 to 26	65
-38 to -35	31	27 to 30	58
-34 to -31	48	31 to 34	36
-30 to -27	49	35 to 38	25
-26 to -23	74	39 to 42	22
-22 to -19	88	43 to 46	18
-18 to -15	95	47 to 50	16
-14 to -11	97	51 to 54	5
-10 to -7	114	55 to 58	1
-6 to -3	90	59 to 62	1
-2 to 2	122		

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Figure 1: Frequency Distribution of HMI Scores (4 point intervals)

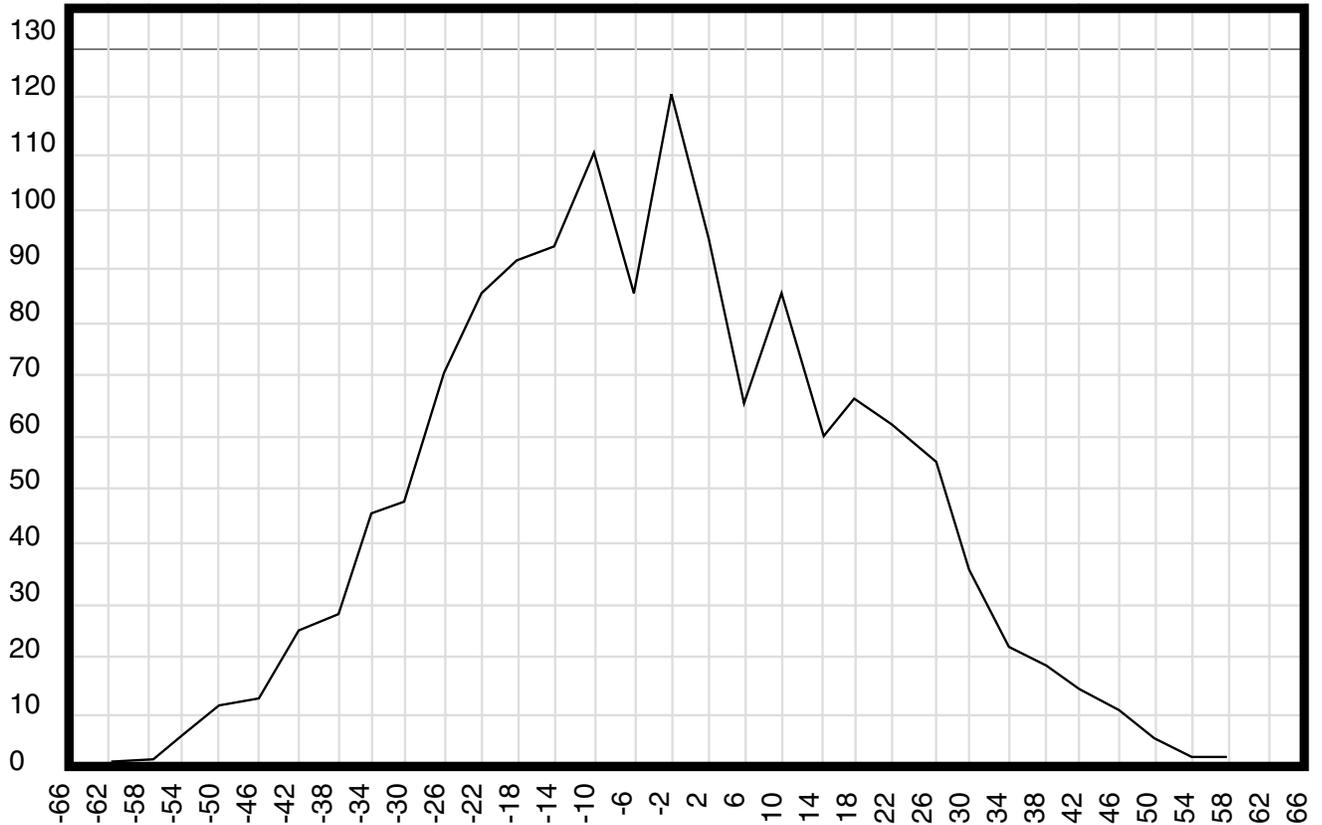


Table 4B: HMI Distribution by Category

		N	PERCENT
LEFT	< -8	607	40.4
LEFT/WHOLE	-8 to -2	143	9.5
WHOLE	-2 to 2	122	8.1
RIGHT/WHOLE	2 to 8	136	9.0
RIGHT	> 8	496	33.0
TOTALS		1504	100.0

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Table 5A: HMI by Sex (Counts)

	MALE	FEMALE	
LEFT	256	329	585
LEFT/WHOLE	52	87	139
WHOLE	42	77	119
RIGHT/WHOLE	34	97	131
RIGHT	126	359	485
TOTALS	510	949	1459

Table 5B: HMI by Sex (Row Percentages)

	MALE	FEMALE	
LEFT	43.8	56.2	100.0
LEFT/WHOLE	37.4	62.6	100.0
WHOLE	35.3	64.7	100.0
RIGHT/WHOLE	26.0	74.0	100.0
RIGHT	26.0	74.0	100.0
TOTALS	35.0	65.0	

Table 5C: HMI by Sex Column Percentages

	MALE	FEMALE	
LEFT	50.2	34.7	40.1
LEFT/WHOLE	10.2	9.2	9.5
WHOLE	8.2	8.1	8.2
RIGHT/WHOLE	6.7	10.2	9.0
RIGHT	24.7	37.8	33.2
TOTALS	100.0	100.0	

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*Table 6A: HMI by Learning Styles (Counts)*

	ONE	TWO	THREE	FOUR	TOTAL
LEFT	54	245	123	43	465
LEFT/WHOLE	26	36	25	19	106
WHOLE	38	22	12	17	89
RIGHT/WHOLE	33	15	14	36	98
RIGHT	102	31	30	185	348
TOTALS	253	349	204	300	1106

*Table 6B: HMI by Learning Style (Row Percentages)*

	ONE	TWO	THREE	FOUR	TOTAL
LEFT	11.6	52.7	26.5	9.2	100.0
LEFT/WHOLE	24.5	34.0	23.6	17.9	100.0
WHOLE	42.7	24.7	13.5	19.1	100.0
RIGHT/WHOLE	33.7	15.3	14.3	36.7	100.0
RIGHT	29.3	8.9	8.6	53.2	100.0
TOTALS	22.9	31.6	18.4	27.1	100.0

*Table 6C: HMI by Learning Style (Column Percentages)*

	ONE	TWO	THREE	FOUR	TOTAL
LEFT	21.3	70.2	60.3	14.3	42.0
LEFT/WHOLE	10.3	10.3	12.3	6.3	9.6
WHOLE	15.0	6.3	5.9	5.7	8.0
RIGHT/WHOLE	13.0	4.3	6.9	12.0	8.9
RIGHT	40.3	8.9	14.7	61.7	31.5
TOTALS	100.0	100.0	100.0	100.0	

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# Appendices

## Professional Networks

### **National Organizations Which Have Endorsed or Certified About Learning (4MAT) Training**

#### **State Departments of Education**

Florida Department of Education - Sponsored 4MAT training

Hawaii Department of Education – Approved 4MAT as one of the models for Comprehensive School Reform in the state.

Illinois State Board of Education – Certified About Learning as an approved Professional Development Provider in the state

Massachusetts Department of Education – Certified About Learning as an approved Professional Development Provider in the state.

New Jersey Department of Education – Certified About Learning and 4MAT Training as an approved Professional Development Provider in the state

North Carolina Department of Public Instruction – Sponsored 4MAT training

Oklahoma Department of Education – Sponsored 4MAT training

Texas Department of Education – Approved 4MAT as one of the models for Comprehensive School Reform in the state.

Wisconsin Department of Education – Approved 4MAT as one of the models for Comprehensive School Reform in the state.

#### **Major School Districts Which Have Endorsed 4MAT Training**

Jefferson County Schools, Birmingham, Alabama

Northeast Independents School District, San Antonio, Texas

Palm Beach County School District, Palm Beach, Florida

Yonkers School District, Yonkers, New York

#### **New York City Department of Education**

Certified About Learning as an approved Professional Development Provider in the New York City Schools

#### **Colorado Department of Workforce Development**

## **International Organizations Which Have Endorsed or Certified About Learning (4MAT) Training**

### **Curriculum Institute of Singapore**

Sponsored 4MAT training

### **Mercuri International**

World's Largest Sales Training Company selected 4MAT as their training design model for all its training in 44 different countries

### **The Centre for Creative Leadership**

has adopted 4MAT as their instructional design for their *Leading Creatively* course.  
Greensborough, NC  
Brussels, Belgium  
Colorado Springs, CO  
San Diego, CA  
Singapore

### **The Ontario Secondary School Teachers Federations (Huff et al., 1986)** recommends the 4MAT system to its members, noting:

This is where teachers must begin...[4MAT is] being done in a very organized way in several boards in Ontario. North York has spent several years incorporating 4MAT into pilot schools...Many other schools and boards are also becoming aware of the possible potential and providing Professional Development opportunities in learning styles for teaching staffs. (p. 41)

### **South Australia Department of Education, Training and Employment (TAFE)**

This education and training unit within the South Australia government has been actively researching and applying 4MAT since 1995. They have found that 4MAT offers a common frame of reference by incorporating other learner-centered principles and theories they were exploring; it is a practical and systematic design tool, enabling them to translate theory into practice; facilitators find that it promotes an environment conducive to learning; and 4MAT training is not only available to them but also provides levels of training, each adding another dimension to their understanding.  
(Palmer, 1999).

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## **Colleges and Universities Teaching 4MAT**

College of Santa Fe, Santa Fe, New Mexico

College of the Southwest, Hobbs, New Mexico

Connecticut College, New London

Doane College, Lincoln, Nebraska

Emporia State University, Emporia, Kansas

Idaho State University, Pocatello

Palm Beach Community College, Palm Beach, Florida

Southwestern College, Chula Vista, California

University of Alabama, Birmingham

University of Arkansas, Little Rock

University of Florida

University of Hawaii, Manoa

University of Massachusetts - Dartmouth

University of Minnesota

University of Nebraska-Lincoln

University of Nebraska-Omaha

University of North Carolina – Chapel Hill

University of Wisconsin, Oshkosh (Center for Career Development)

University of Wyoming, Laramie

Weber State University, Ogden, Utah

## **Additional Sponsors of 4MAT Training**

American Association of School Administrators

Association for Supervision and Curriculum Development

Center for Creative Leadership

Education Commission of the States

Florida Department of Labor

IDEA: Institute for Development of Education Fellows Program

National Association of Corrections

National Association of Elementary School Principals

National Association of Secondary School Principals

National Staff Development Council

School Administrators Association of New York (SAANYS)

Superintendent's Association (The state of Florida)

The Smithsonian Institute

The U.S. Department of Housing and Urban Development (HUD)

The United States Navy

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## About Learning Position Papers

### The Education of Multiple Intelligences

#### A Position Paper of About Learning, Incorporated

*November, 1997*

This paper articulates About Learning, Inc.'s position on the issue of multiple intelligences. It is our hope that this paper will aid 4MAT practitioners in articulating the connections between the 4MAT Method of Instruction and this critical educational issue.

It is also our intent to distribute this information to as many qualified educators as possible since our goal is to aid them in understanding how The 4MAT Method of Instruction can provide valuable assistance in honoring the multiple methods through which people learn.

To this end, we encourage you to copy and distribute this paper.

About Learning, Inc. is a research, publishing, and consulting firm that provides training and consulting in the effective use of 4MAT. 4MAT is an innovative framework that capitalizes on natural learning processes used by everyone.

For information on our products and training, please contact us at (800) 822-4MAT. Or write us at About Learning, Inc., 1251 N. Old Rand Road, Wauconda, IL 60084.

### The Education of Multiple Intelligences

#### A Position Paper of About Learning, Inc. by Bryant Lindsey, Ed.D.

*November, 1997*

Not too long ago, many educators thought about intelligence as a single number, an “intelligence quotient” (or “IQ”), which could be measured by a test that took only about an hour and which remained unchanged throughout life. Now we’re all fairly sure that (1) there are multiple intelligences and, furthermore, that (2) intelligence may be increased (Perkins, 1995).

#### How Many Intelligences Are There?

Since the publication of Howard Gardner’s *Frames of Mind: The Theory of Multiple Intelligences* (1983), educators have grown more comfortable with the idea that intelligence is too complicated and too important to be represented by a single number such as those commonly derived from IQ (intelligence quotient) tests. But how many intelligences are there and what difference does it make whether there is one intelligence, or two intelligences (such as “right mode” and “left mode” intelligences), three intelligences, seven intelligences, or, for that matter, 120 intelligences, or even more?

In fact, psychologists, neurophysiologists, and geneticists may debate for many years about exactly how many intelligences there are and how they are related. For example, Gardner himself defined seven intelligences in his seminal work; but, he has not limited himself to only seven. Other psychologists, such as Robert Sternberg (1996), have preferred to define fewer — three in the case of Sternberg. Some psychologists still emphasize that there may be only one really important intelligence — the IQ. And some have preferred to define many more intelligences than either Gardner or Sternberg — more than thirty years ago Guilford (1967), for example, found it helpful to specify as many as 120 “factors” in his “structure of the intellect”.

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About Learning, Inc. with its 4MAT System of Instruction (McCarthy, 1996, 1987, 1981) is prepared to address the question of how intelligences should be educated without prejudging the question of how many intelligences there are or whether they can yet be measured adequately. About Learning, Inc. has found that 4MAT is very powerful in its implications for the education of multiple intelligences — just as About Learning, Inc. has found that theoretical work on multiple intelligences is very powerful in its implications for the 4MAT System.

### **How Fast We Are Learning Things About the Brain**

In a recent presentation to About Learning, Inc., Robert Sylwester (1997) pointed out that most of what we know about the brain we have learned in the last 10 years, and most of that we have learned in the last two (!) years. Moreover, the rate at which we are learning about the brain does not appear to be slowing down. How does this progress relate to multiple intelligences?

Gardner (1993) himself notes that within a few decades neuroscientists will have far firmer knowledge about the organization and development of the brain. “After years of observing mental processes as they actually occur in the living brain, they will be able to describe the neural structures that are entailed in the conduct of various intellectual activities; they will be able to indicate the extent to which these activities are actually independent of one another; and they will know to what extent individuals who are exceptional performers in one or another intellectual realm actually exhibit neural processes that differ from those exhibited by less extraordinary individuals. Genetic studies are likely to reveal whether specific intellectual strengths (such as musical or spatial intelligence) are under the control of individual genes or gene complexes.” So, we can expect that we will know much more about the existence of multiple intelligences and their interrelationships in the not-too-distant future. In the meantime, About Learning, Inc. is committed to incorporating new findings about the brain and about multiple intelligences into the 4MAT System as soon after they become known as possible.

### **4MAT® Learning Styles, and Multiple Intelligences**

Gardner (1993) states: “While lip service is paid to the existence of differences among students (and among teachers!), there have been few systematic attempts to elaborate the educational implications of these differences. Should a sensitivity to different intelligences or learning styles become part of the ‘mental models’ constructed by new teachers, the next generation of instructors are far more likely to be able to reach each of their students in the most direct and effective way.

### **The 4MAT System: A Singular Method for Creating Multiple Approaches to Learning.**

The 4MAT Framework is a useful model for integrating a variety of student abilities and capacities into the instructional process. The following three descriptions provide an overview of About Learning, Inc.’s view on how Multiple Intelligences Theory overlays onto the 4MAT Method of Instruction.

### **Right and Left Mode Techniques**

The overlay of both kinds of hemispheric operations on each of the four quadrant sections of the 4MAT Natural Cycle incorporates multiple intelligence dimensions. The Left Mode operating with analysis, examining cause and effect, breaking things down, categorizing, using verbal language

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and symbols, abstracting experience, generating theory, and working in sequence- the Right mode operating out of being, intuiting, seeing wholes, forming images and mental combinations, seeking and using patterns, relationships and connections, using nonverbal language, manipulating form and space and working simultaneously- these together bring the fullness of multiple processing to the instructional design of the 4MAT classroom teacher.

## Modalities

The simple addition of nonverbal strategies, activities and assessments that incorporate the notions of auditory, visual and kinesthetic into each 4MAT unit creates a simple, but elegant way to instantly apply the theory of multiple intelligence to classroom instruction.

## The 4MAT Cycle of Learning

4MAT is formed from the perceiving and processing dimensions of the natural learning cycle. The four quadrants embody the essential elements of learning: feeling, reflecting, thinking and acting. All successful learning deals with these four elements and answers

The four questions: Why? What? How? If? When teachers design instruction around this cycle, they need to...

- Establish personal meaning (Intrapersonal Intelligence)
- Explore diverse opinions and viewpoints (Interpersonal Intelligence)
- Conceptualize and structure knowledge (Logical/Linguistic Intelligence)
- Promote usefulness and transferability (Spatial Intelligence), and
- Encourage Creative Expressions of Knowledge

Musical and Bodily/Kinesthetic Intelligences are incorporated throughout mostly through the 4MAT design emphasis on Right Mode strategies. Mathematical Intelligence is used when math is specifically taught as well as when it is appropriate to enhance meanings, ideas, skills or individual projects.

## Extended Staff Development for Multiple Intelligences

About Learning, Inc. is prepared to work with local educational agencies on a continuing basis to help them implement innovative approaches dealing with multiple intelligences. About Learning, inc. welcomes inquiries concerning multiple-intelligence theory and other educational innovations. Inquiries may be directed to Susan Morris, Director of Education and Training of About Learning, Incorporated, at 1251 N. Old Rand Road, Wauconda, Illinois 60084. Telephone: 847/487-1800; Fax: 847/487-1811; Email: susan@aboutlearning.com

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### **About the Author**

Bryant Lindsey is a writer and educator trained at Duke, William and Mary, and N.C. State University.

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## **Inclusion of Students with Special Needs— 4MAT Helps**

### **A Position Paper of About Learning, Incorporated**

*November, 1997*

This paper articulates About Learning, Inc.'s position on the issue of inclusion. It is our hope that this paper will aid 4MAT practitioners in articulating the connections between the 4MAT Method of Instruction and this critical educational issue.

It is also our intent to distribute this information to as many interested educators as possible since our goal is to aid them in understanding how The 4MAT Method of Instruction can provide valuable assistance in addressing inclusion through curricular design.

To this end, we encourage you to copy and distribute this paper.

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## **Inclusion of Students with Special Needs – 4MAT Helps**

### **A Position Paper of About Learning, Incorporated by Bryant Lindsey, Ed. D., and Alix Pearce, M. A. T.**

*November, 1997*

Following enactment in 1975 of Public Law 94 -142 (which has since been renamed the “Individuals with Disabilities Education Act” (IDEA)), local educational agencies all across the United States have attempted to provide “disabled students” with a free, “appropriate” public education in “the least restrictive environment.” Specifically, the law states “to the maximum extent appropriate, handicapped children...are (to be) educated with children who are not handicapped, and that special classes, separate schooling, or other removal of handicapped children from the regular educational environment (should occur) only when the nature or severity of the handicap is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily.” (P. L. 94-142, Section 1412 [5] [B]).

Nevertheless, for many years following original enactment of P. L. 94-142, most special education was characterized by separating “disabled students” from “normal students” for substantial periods of each week for the purpose of giving them special assistance away from “normal” classrooms. When it came to regular classrooms, students with special needs were not really, in a word, “included.” That has changed and is continuing to change — dramatically. Now there is an effort nationwide to be more “inclusive” in our policies regarding students with special needs.

Why has the situation changed so dramatically? Why has “inclusion” emerged as a major policy priority for advocates of students with special needs? The situation has changed primarily because our understanding of what is “appropriate” and of what constitutes a “least restrictive environment” has evolved markedly since 1975. In this regard, Villa and Thousand (1995) point out that “in 1975...the professional education literature was void of any information or strategies for using supplementary aids and services to effectively include students with disabilities.

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However, since that time, the use of supplementary aids and services to effectively include all students has been frequently identified and described in the literature”. In short, our classrooms are becoming more inclusive because we are learning how to have better, more inclusive classrooms.

### **Inclusion is Not Just a Fad**

Additionally, with the development and elaboration of The 4MAT System of Instruction (McCarthy, 1981, 1987, 1996) we have a pedagogy for systematically addressing the needs of all types of learners. About Learning, Inc.’s 4MAT is a powerful tool for organizing and delivering instruction in both “regular” and “special” classrooms. With the increased diversity of students in “inclusive” classrooms and schools, many teachers find 4MAT virtually indispensable for instructional design.

For these and many other reasons, About Learning, Inc. agrees with Kochhar and West (1996) that “inclusion is not just a fad”. If only because of the increasing number of students with special needs and the added emphasis of federal and state courts on “least restrictive environment”, About Learning, Inc. expects that there will be more inclusion in the future rather than less. About Learning, Inc. and 4MAT can help any local educational agency in any state to improve its efforts at inclusion and to get ready for the more inclusive classrooms of the future.

### **“Good” Inclusion and “Bad” Inclusion**

4MAT can make the difference between “good” inclusion and “bad” inclusion. In the words of Kochhar and West (1996): “It is the 1990’s, and the journey toward integration of all children and youths within their community schools has only just begun. The inclusion of children (with special needs) into regular classes has accelerated quickly in the past decade and in many places has occurred too fast and without adequate planning for restructuring. There is growing concern by teachers, special educators, and administrators that many ‘bad’ inclusion policies are being implemented. Such inclusion efforts are failing to provide the necessary supportive services that students with disabilities need when they are placed into regular classrooms. On the other hand, there are many models of ‘very good’ inclusion.”

About Learning, Inc. can help any local educational agency devise models of “very good” inclusion. In particular, About Learning, Inc. believes no local educational agencies should any longer have to use what have been called “dump-and-hope” methods of inclusion.

### **Why Implementation of Inclusion Should Include 4MAT**

4MAT addresses the natural, experiential cycle of learning that takes learners from (1) personal meaning to (2) conceptualization to (3) practice to (4) creative applications — by incorporating learning-style theory and wholebrain-processing theory.

Inclusion is better with 4MAT — markedly better, we think — for at least five reasons:

1. Philosophy of 4MAT. The very philosophy of 4MAT complements the idea of “inclusion”. Students can be learning-different and yet be successful. Both the concepts of inclusion and of 4MAT celebrate diversity and promote the idea that a teacher can meet the needs of all students, however different.
2. Structure for Planning. 4MAT provides a structure for planning which helps the teacher focus on the critical content. Teachers need to decide what is critical for every student to

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know and to be able to do. The brainstorming component of 4MAT also encourages them to decide what content can be eliminated for some or added for others. It encourages them to think about how the delivery of the content can be adapted to students — building in right- and left-mode activities, using multiple intelligences and modalities. It encourages them to look at overlying themes or concepts.

3. Emotional Link to Content for Students. The first part of 4MAT's natural learning cycle is critical to everyone, but especially to the "at risk" student — who may be learning disabled, gifted, or from a deprived background — and who needs an emotional link to the content and relationships with teachers and fellow students. It provides a level playing field for all the students, whatever their backgrounds.
4. "Differentiation of Instruction" for All Students. The real differentiation of instruction will come primarily in the middle parts of 4MAT's natural learning cycle. Some students will need to spend more time in acquisition of skills, for example, and the products of their learning may be limited by their abilities, interests, and needs. Others will "dive into" making the learning their own. 4MAT encourages giving students choices in extending and personalizing their learning. A good teacher will make sure the choices reflect the needs of students and that the evaluation will as well.
5. "Over-Identification" of Students With Special Needs — Reduced Costs? Many educators believe we may have serious problems with "over-identification" of students who have special needs. Some educators competent in both special education and 4MAT believe that proper use of 4MAT by schools and local educational agencies can reduce the "over-identification" of youth who need to be classified as "students with special needs". This is because 4MAT honors the unique learning styles of all students and helps them find success rather than frustration. To the extent this is possible, 4MAT implementation may be able to help reduce local, state, and federal costs associated with "over-identification".

## Extended Staff Development for Inclusion

About Learning, Inc. is prepared to work with state and local educational agencies on a continuing basis to help them plan and implement policies for inclusion of children with special needs into regular classrooms as well as to evaluate and improve inclusion during and after implementation. Numerous 4MAT clients have had success with inclusion.

About Learning, Inc. offers a three-tiered, train-the trainer program as well as assistance with strategic, long-range planning for school districts that want to implement 4MAT. Implementation is custom-designed and includes on-going coaching and instruction in order to meet the specific needs of school cultures and school-district cultures.

Inquiries concerning 4MAT and inclusion may be directed to Susan Morris; Director of the Education Division; About Learning, Incorporated; 23385 Old Barrington Road; Barrington, Illinois 60010. Numbers are 847-382-7272 (phone), 847-382-4510 (fax), and susanm@excelcorp.com (e-mail).

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### **About the Authors**

Bryant Lindsey is a writer and educator trained at Duke, William and Mary, and N.C. State University. Alix Pearce, with degrees from Sweet Briar and Brown, is Supervisor of Gifted Education for Stafford County (VA) Schools and has trained with 4MAT since 1989. Her staff development 4MAT plan, “Differentiating Instruction for the Gifted Student in the Heterogeneous classroom”, is available through About Learning, Inc..

## **Cooperative Learning: Better with 4MAT**

### **A Position Paper of About Learning, Incorporated**

*November, 1997*

This paper articulates About Learning, Inc.'s position on the issue of cooperative learning. It is our hope that this paper will aid 4MAT practitioners in articulating the connections between the 4MAT Method of Instruction and this critical educational issue.

It is also our intent to distribute this information to as many qualified educators as possible since our goal is to aid them in understanding how The 4MAT Method of Instruction can provide valuable assistance in creating learning environments that foster greater cooperation among students.

To this end, we encourage you to copy and distribute this paper.

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## **Cooperative Learning: Better with 4MAT**

### **A Position Paper of About Learning, Incorporated by Bryant Lindsey, Ed. D.**

*November, 1997*

### **The Instructional Challenges of Cooperative Learning**

We now know much more about the effects of cooperation and competition on learning than we did a few decades ago. Thanks to the work of Johnson and Johnson (1991), Slavin (1983) and numerous other dedicated researchers and educators, we now have a framework for stating when and where it is most helpful to use "cooperative", "collaborative", and/or "individualistic" learning techniques in the classroom. The now extensive literature on cooperative, collaborative, and individualistic learning is worthy of study in its own right. But, it is also worthwhile to ask how this literature relates to time-tested, research-based, teaching and learning techniques, as included in About Learning, Inc.'s 4MAT System of Instruction; and it is the purpose of this position paper to address this question.

### **Cooperation Is the Forest**

Johnson and Johnson (1991) point out that cooperation is the basis for all learning and, in their opinion, this is not to say that "the skills of ... individualization are unimportant. They are important, but only within the larger context of cooperation with others, and a person needs to know when to ... work individually and when to cooperate. Unfortunately, instruction in schools at present seems to stress competition or perhaps individualization without much attention to the skills needed to facilitate effective cooperation. To encourage a positive and effective learning environment and to promote the achievement and socialization outcomes of schools we must

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realize that cooperation is the forest -- competition and individualism are but trees."

## **4MAT and Cooperative Learning: Together is Better**

No one has yet written a definitive text, so far as we are aware, on the relationship of cooperative learning to (1) learning styles, (2) the natural learning cycle, and (3) the 4MAT System. But, About Learning, Inc. has found that educators who are well-versed in using cooperative learning strategies are easily able to "overlay" cooperative learning techniques onto the natural learning cycle once they have learned 4MAT. Furthermore, a deeper understanding of the optimal effects of cooperative and individual learning results from applying these techniques within the framework of the natural learning cycle rather than in using the techniques by themselves.

The structure of the 4MAT framework provides teachers and designers of instruction with a balanced vehicle for addressing cooperative learning strategies throughout a complete lesson plan. The basic flow of a 4MAT-planned unit makes it especially useful to cooperative learning practitioners. Here's how 4MAT works:

### *1. Quadrant One: Connection to Personal Meaning*

All effective 4MAT planned lessons begin with a teacher-directed experience that directly engages learners with a connection to a concept drawn from the content to be taught. It is critical for this initial learning environment to be imbued with the quality of trust that will enable each participant to share personal perceptions and opinions, to dialog about the quality of the shared experience, and to reach some agreed-upon consensus that provide a focus on the specifics of the content to come. Cooperative discussion is critical to this part of the learning, and it is critical for both the teacher and the students to understand the basics of group process strategies.

### *2. Quadrant Two: Conceptualization*

Once content focus has been fostered, the teacher moves to the more formal direct-teaching part of the 4MAT cycle, the place where the specifics of the content are addressed. Although this part of the cycle most often involves individual learning, it can often be enhanced by having learners participate in the acquisition of new knowledge through strategies and/or learning contracts for that enable them to share new information with peers.

### *3. Quadrant Three: Practice*

When learners have acquired new knowledge, it is necessary for them to test, try and tinker with what they have learned. It is the place for the learners to take over the learning, a place for learning together and for learning alone. 4MAT practitioners find the need for cooperative learning strategies to be critical to the flow of instruction at this stage of the natural cycle, especially if they choose to give their students project options for exploring and extending what has been learned.

### *4. Quadrant Four: Creative Applications and Personal Integration*

As students are engaged in applying what they have learned in new and innovative ways, 4MAT provides great opportunities for students to not only work on projects in cooperative groups but also to use each other for feedback and editing when they have chosen to work on their creations alone. With 4MAT designed instruction, the teacher has a balanced framework for ensuring that students experience the strategies which are most appropriate to the learning at hand.

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The 4MAT System thus provides a context, perhaps, the most powerful and instructive context available, for determining whether and when to use particular cooperative and individual learning techniques. Although we find that cooperative learning may be particularly important at the beginning and end of the natural learning cycle, in practice it may be used helpfully throughout the cycle.

About Learning, Inc. also thinks that learners with particular learning styles may be more inclined to cooperative, collaborative, and individual learning techniques, respectively, than learners with other learning styles, although this is a question deserving of further study. So, it is important to know how to offer a variety of techniques -- whether cooperative, collaborative, or individual--to learners with particular styles, when appropriate.

Finally, About Learning, Inc. notes that much of the positive effect of cooperative learning techniques—particularly in the lower grades – can be initiated by individual teachers and schools in conjunction with the 4MAT System without major policy changes.

## **Extended Staff Development for Cooperative Learning**

4MAT clients have had success with cooperative learning. About Learning, Inc. is prepared to work with local educational agencies on a continuing basis to help them implement cooperative learning programs, to evaluate cooperative learning programs, and to make cooperative learning programs successful after initial implementation.

About Learning, Inc. offers a three-tiered, train-the-trainer program as well as assistance with strategic, long-range planning for school district that want to implement 4MAT. Implementation is custom-designed and includes on-going coaching and instruction in order to meet the specific needs of individual school cultures and school-district cultures.

## **Inquiries Welcomed by About Learning, Incorporated**

About Learning, Incorporated, welcomes inquiries concerning block scheduling and other educational innovations. Inquiries concerning block scheduling may be directed to Susan Morris, Director of the Education and Training of About Learning, Inc., at 1251 N. Old Rand Road, Wauconda, Illinois 60084. Numbers are 847-487-1800 (phone), 847-487-1811 (fax), and susan@aboutlearning.com (e-mail).

## Block Scheduling: Issues and Answers

### **A Position Paper of About Learning, Incorporated**

*January, 1998*

This paper articulates About Learning, Inc.'s position on the issue of block scheduling. It is our hope that this paper will aid 4MAT practitioners in articulating the connections between the 4MAT Method of Instruction and this critical educational issue.

It is also our intent to distribute this information to as many qualified educators as possible since our goal is to aid them in understanding how The 4MAT Method of Instruction can provide valuable assistance in the implementation of block scheduling.

To this end, we encourage you to copy and distribute this paper.

About Learning, Inc. is a research, publishing, and consulting firm that provides training and consulting in the effective use of 4MAT. 4MAT is an innovative framework that capitalizes on natural learning processes used by everyone.

For information on our products and training, please contact us at (800) 822-4MAT. Or write us at About Learning, Inc., 1251 N. Old Rand Road, Wauconda, IL 60084.

## Block Scheduling: Issues and Answers

### **A Position Paper of About Learning, Incorporated**

**by Bryant Lindsey, Ed. D.**

*January, 1998*

In 1991, the United States Congress established the National Education Commission of Time and Learning to examine educational change initiatives in America. In 1994 this commission published a detailed analysis of existing educational reform efforts, including various projects designed to improve school scheduling practices and increase time allocated for meaningful academic inquiry (Canady and Rettig, 1995). In general the commission's report highlighted the shortcomings of traditional school organizational practices, particularly the problems associated with six and seven period class schedules. Additionally, and perhaps more vital, the commission report also chronicled the often daunting problems good teachers encountered as they attempted to conduct relevant learning activities while managing an innumerable set of required non-academic tasks.

Allocating larger blocks of time for individual class sessions has been suggested as one approach schools can use to foster more in-depth academic inquiry and provide time for a variety of teaching/learning strategies. "Block scheduling," a term commonly used in the literature to describe experimental scheduling plans which reduce the number of classes offered each day in order to allocate additional time per class period for student inquiry (and offer teachers expanded options for incorporating varied instructional activities), is one promising option for reforming existing practice (Cawelti, 1994).

### **Appropriate Use of Additional Time**

However promising, block scheduling has received mixed reviews in the educational community. In schools where blocks are being evaluated favorably teachers are part of a school wide

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effort to create collaborative systems which result in a change in the ways teachers teach. In schools where “blocks” have not been successful the culprit is usually a failure to provide adequate preparation for teachers to change their teaching repertoire. In the final analysis, the block schedule is a necessary but not sufficient variable related to improving student performance. The critical variable is relevant changes in the ways teachers teach which can be facilitated by the provision of additional time.

## **The Single Most Important Factor**

In short, if we have learned anything from block scheduling reform efforts it is that the “single most important factor in determining the success or failure of block scheduling programs will be the degree to which teachers successfully alter instruction to utilize extended time blocks effectively. “If instructional practices do not change, the block scheduling movement of the 1990’s...will be buried in the graveyard of failed educational innovations.” Canady and Rettig (1995). However, because changes in school schedules “often constitute a profound educational change for a school community,” changing teacher perceptions about the nature of teaching is pre-requisite to changing instructional practices. Additionally, according to Bernice McCarthy, changes in teacher perceptions, when linked to collaborative opportunities to experiment with research-derived instructional strategies yield the most lasting improvements.

## **The 4MAT System -- The Key to Successful Block Scheduling**

The 4MAT System is a powerful tool for organizing and delivering instruction. 4MAT addresses the natural, experiential cycle of learning that takes learners from (1)personal meaning to (2)conceptualization to (3)practice to (4)creative applications. 4MAT also provides a pedagogy for systematically addressing the needs of different types of learners.

Using Bernice McCarthy’s 4MAT System (McCarthy, 1981, 1987, 1993) teachers can maximize the use of additional time provided by block schedules. Unlike many theoretical systems, 4MAT is a tool which can be used immediately to improve classroom instruction.

4MAT offers teachers a framework for designing instruction that helps students...

- Attribute personal meaning to what they are learning;
- Create meaningful, coherent representations of knowledge;
- Link new information with existing knowledge;
- Reflect and analyze concepts;
- Problem-solve and problem-find critical issues;
- Engage in active processing including opportunities for self-expression, group work, discussions, practice, evaluation and synthesis of material to be learned.

## **Extended Staff Development for Block Scheduling**

About Learning, Inc., distributors and proponents of The 4MAT System, is prepared to work with local educational agencies on a continuing basis to help them implement block scheduling, to evaluate block scheduling, and to make block scheduling successful after initial implementation. About Learning, Inc. offers a three-tiered, train-the-trainer program as well as assistance with strategic, long-range planning for school districts that want to implement 4MAT.

Please contact us for referrals or research on the impact of 4MAT in block scheduled schools.

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4MAT can be used very successfully in high schools which are beginning block scheduling or which have already begun block scheduling.

## **Inquiries Welcomed by About Learning, Incorporated**

About Learning, Incorporated, welcomes inquiries concerning block scheduling and other educational innovations. Inquiries concerning block scheduling may be directed to Susan Morris, Director of the Education and Training of About Learning, Inc., at 1251 N. Old Rand Road, Wauconda, Illinois 60084. Numbers are 847-487-1800 (phone), 847-487-1811 (fax), and susan@aboutlearning.com (e-mail).

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## **About the Author**

Bryant Lindsey is a writer and educator trained at Duke, William and Mary, and N.C. State University.

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