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## Helping children with difficulties learn : an overview

Sherry Marie Jack  
*University of Northern Iowa*

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## Helping children with difficulties learn : an overview

### Abstract

The purpose of this paper is to integrate multiple variables related to learning for children with special needs. Regarding the first variable, intelligence, the paper considers its history, development, and biological foundations. Gardner's contemporary theory of Multiple Intelligence is also discussed. Then a discussion of learning styles, including the history, identification procedures and matching styles to instruction, is provided. Finally, the paper takes a historical journey through the learning process, to discuss the works of numerous authors in their related fields.

**Helping Children with Difficulties Learn: An Overview**

By:

Sherry Marie Jack

Submitted in Partial Fulfillment  
of the Degree

Masters of Arts in Education  
General Education Psychology

University of Northern Iowa  
Cedar Falls, Iowa

This Research Paper by: Sherry Marie Jack

Entitled: Helping Children with Difficulties  
Learn: An Overview

has been approved as meeting the  
research paper requirement for the Degree of

*Master of Arts in Education: General Educational Psychology*

Donna Raschke

---

Director of Research Paper

Barry Wilson

---

Co-Reader of Research Paper

---

Co-Reader of Research Paper

---

Graduate Faculty Advisor

Barry Wilson

---

Head, Department of Educational  
Psychology & Foundations

8-9-99

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Date Approved

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## Chapter I

### Introduction

Enter a traditional classroom and you will see many students seated in desks attempting to learn by listening to the teacher or reading a book. According to Gardner (1983), it can be assumed that each child is intelligent in one area or another, but by the vacant stares and glazed-over eyes, it appears that the information being provided is not being effectively processed for many students.

Acquiring and processing information requires students to integrate multiple incoming stimuli across sensory systems. The literature suggests that most students learn best through a specific channel of senses or perceptions (Barbe & Swassing, 1979; Dunn & Dunn, 1978). Some students appear to learn best through their sense of kinesthetic or tactual touch, while others appear to learn best through their auditory or visual channels. The style which individuals best receive and retain information has been labeled one's learning style or modality input preference (Barbe & Swassing, 1979; Weed & Ryan, 1982).

However, it should be noted that empirical validation regarding the modality preference theory is questionable at best. Very few well designed and controlled investigations documenting the efficacy of this approach are cited in the literature. Most classrooms include learners who process information in diverse ways. Some have an input channel preference while some appear to be multi-sensory learners. Multi-sensory learners process information simultaneously incorporating a multi-sensory orientation for processing information (Barbe & Swassing, 1979).

Many professionals believe learning styles are genetically determined, independent of environmental factors, while others believe environmental factors affect and influence one's preferential style for learning. Learning style, or preference, is based on the assumption that most individuals have one modality that best helps them to process and retain information. This particular modality is then labeled as their modality preference i.e. optimal style for learning and processing information (Barbe & Swassing, 1979; Gardner, 1980).

According to many professionals, student performance and motivation increases when the teaching style coincides with the learning style of the student (Barbe & Swassing, 1979; Dunn & Carbo, 1981; Dunn & Dunn, 1978). Research suggests that most teachers teach in a way that emphasizes their own preferred style for learning. For example, if the teacher is predominantly a visual learner, he/she is likely to emphasize visual techniques for retaining and recalling information in his/her classroom (Barbe & Swassing, 1979). It is speculated that teachers who have the skills and competencies to present information and ideas in various ways in their classroom emphasizing differing learning channels will increase learning for students who best process information via differing learning channels (Hunt, 1982). Dunn (1979) further speculates that when slow learners are unable to learn with traditional methods, achievement can increase when teachers present information and ideas utilizing multisensory approaches.

The purpose of this paper is to integrate multiple variables related to learning for children with special needs as can be noted in Figure 1. The main limbs depict the four major themes



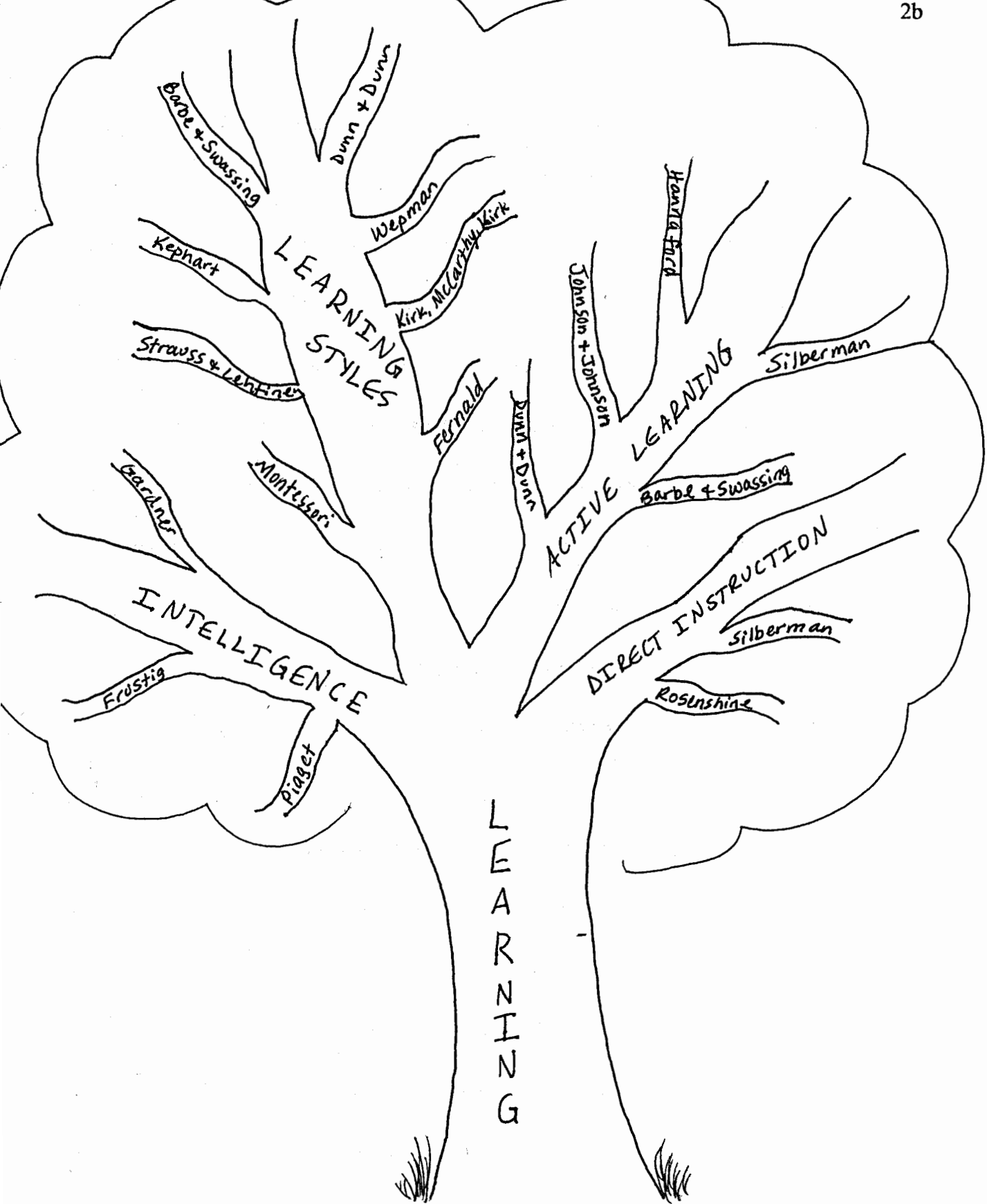


Figure 1 Overview of topics and authors

discussed in this paper with a sample of individuals noted on the branches. Surveying the limbs left to right begins the paper's historical journey describing best practices for children with special needs across time by addressing a variety of interventions and variables which have been implemented to help children learn and process information. The first variable, intelligence, considers the history, development, and biological foundations. Gardner's contemporary theory of Multiple Intelligence will also be discussed. Then, a discussion addressing the exploration of learning styles including the history, identification procedures and matching styles to instruction will be provided. The intent of this information is to lay historical groundwork which addresses differing approaches which have been implemented to help children learn and acquire information. One area in particular, the kinesthetic/tactual approaches for presenting information is described in depth in preparation for an investigation comparing learning rates when two differing instructional models are implemented. A description of the Direct Instruction Model and the Distar curriculum which emphasizes a direct instructional approach and was designed to assist children with learning disabilities will be provided to illuminate the discussion.

As this paper took its historical journey through the learning process, it was necessary to discuss the works of numerous authors in their related fields. Intellectual abilities appeared to serve as a foundation in which the learning process could develop. With this in mind, the paper began with Gall's observations and correlations which led Wundt and James to develop the notion of psychology as a science. Because Piaget was a major contender in the area of cognitive

development, his work was also discussed. This theory was followed by Gardner's modern view of cognitive abilities with his Theory of Multiple Intelligence. Gardner's theory was chosen because of his holistic approach to find areas of strength beyond cognitive abilities within each individual. Applications of this theory in the classroom led to the discussion of individual learning styles. The works of Barbe and Swassing were selected as they appeared regularly in the reviewed literature. Rita and Kenneth Dunn's hypotheses and implications were brought into the literature review due to the popularity of their research involving learning styles. One learning style in particular, the active or kinesthetic approach, was selected because it appears to be one of the least popular methods, compared to visual and auditory approaches, used for learning in the classroom. In the quest for information with an active approach for learning, sources by Silberman and another by Hannaford were discovered and used in this paper. In an anticipated study comparing learning rates, it seemed natural to consider a more passive approach to learning which led to a review of the model of Direct Instruction, and more specifically, the Distar curriculum.

## Chapter II

### Review of the Literature

#### Intelligence

##### Definitions of Intelligence

Intelligence is represented by a two or three digit number obtained by taking a standardized test. On this standardized test, subjects are asked to demonstrate their knowledge or ability to recall information, vocabulary, arithmetic skills, remember series of numbers, grasp similarities between two elements, solve mazes, or arrange pictures to complete a story. Once this number is determined, the subject is assigned his/her intelligence quotient or IQ. In our culture, the IQ score will influence thoughts and expectations of him/her as well as his/her eligibility for privileges. The IQ is said to predict an individual's ability to perform in school and the higher the score, the more likely he/she is to excel (Gardner, 1983; Hoerr, 1996).

Intelligence is operationally defined through achievement tests. The results indicate whether the student is working at, above, or below grade level (Hoerr, 1996). Alfred Binet developed the concept of IQ in an attempt to identify which students would do well in school (Hoerr, 1996).

Intelligence has been defined as ". . . the human ability to solve problems or to make something that is valued in one or more cultures." (Checkley, 1997, p. 8) This definition is refined as it points out the relationship between intelligence and culture which may include

intellectual abilities like writing a song, creating a sculpture, dancing, or leading a group through a forest (Hoerr, 1996).

Gardner's idea of "human intelligences" or "frames of mind" suggest ". . . evidence for the existence of several relatively autonomous human intellectual competences" (1983, p. 8). The exact nature or potential of each intelligence as well as the exact number of intelligences has yet to be determined. It is difficult to deny the fact that some intelligences exist independent of one another, yet they may be combined to adapt to individuals and cultures (Gardner, 1983).

Previous attempts to identify independent intelligences have yielded less competent than multiple intelligences as they are based on separate "minds". These separate minds have been solely based on one of logical analysis, intelligence testing or brain study. Gardner, however, has reviewed a large variety of sources including studies of prodigies, gifted individuals, brain-damaged patients, idiot savants, normal children and adults, experts from a variety of fields, and individuals from a variety of cultures. An introductory list of intelligences was reinforced by converging evidence from a wide variety of sources. Gardner is convinced that an intelligence can be isolated to particular populations, advanced in particular individuals or cultures, or may display core abilities definable by professionals (Gardner, 1983).

Gardner's purpose for implementing his theory of multiple intelligence is fourfold. First of all, he wishes to expand cognitive and developmental psychology towards the biological and evolutionary roots of cognition and cultural variations in cognitive competence. Second, he

wishes to consider the educational implications of the theory of multiple intelligences. Third, he hopes to encourage others to develop a model incorporating intellectual competences within various cultural settings. Finally, he hopes that multiple intelligences will be utilized by policy makers and practitioners whose goal is to assist in the development of an individual's capabilities (Gardner, 1983).

### Origin/Development of Intelligence

During the later eighteenth century, Franz Joseph Gall observed correlations between mental characteristics and the shapes of people's heads. Years later, known as the science of phrenology, this concept was further expanded by his colleague Joseph Spurzheim. Phrenology, defined as identifying strengths and weaknesses of character and mental capacity by studying the configuration of individuals (Boring, 1950), reached enormous popularity by the early nineteenth century. As with most theories, flaws were recognized, yet it would be a mistake to dismiss the theory altogether. Gall was one of the first to identify that different parts of the brain have different functions. This led to several attempts to identify the physical roots of mental function and specific claims of mental functioning during the nineteenth century (Gardner, 1975).

During the last half of the nineteenth century, Wilhelm Wundt and William James opened the doors to psychology as a science in their attempts to separate from physiology and neurology of the brain. This new psychology looked at the brain's mental abilities like memory, perception and attention while the others focused on mental capabilities like language or music (Gardner,

1983).

The idea of measuring and comparing individuals began with Francis Galton's development of a statistical method to rank the physical and intellectual powers of humans. This evolved into identifying more complex capacities like language and abstraction (Galton, 1907). Alfred Binet and his colleague Theodore Simon took this concept to the next level by developing the first intelligence test. The purpose of this test was to differentiate retarded children from non-retarded children within their appropriate grade level. Enthusiasm and excitement over intelligence testing continued to rise and soon specific purposes for testing became widespread for a variety of purposes including institutions like the school, military, industrial placement, and social companionship (Boring, 1950).

These instruments while used extensively to identify and predict an individual's potential and capabilities were later found to be biased in favor of scholastic societies, particularly those accustomed to paper and pencil tests (Jensen, 1980). While these tests have been shown to have predictive abilities for schooling success, they have been shown to have limited predictability regarding an individual's performance and success outside the context of the school setting (Block & Dworkin, 1976).

### Piaget's Cognitive Development

In 1920, a Swiss psychologist named Piaget was working as a researcher in Simon's laboratory. He began to focus on errors children made while taking an intelligence test. Piaget

considered the child's reasoning for incorrect answers to be more important than the accurate response. This was a complete shift from a total focus on correct responding to a focus on an individual's reasoning processes (Gardner, 1981).

Piaget never actually critiqued Binet's work, but clearly this individual saw a need to look further at an individual's pattern of responding than to simply label the response as correct or incorrect. In contrast, Binet implied that testing IQ was empirical with no consideration of process and believed the tasks on the tests to be microscopic and unrelated to one another. Consequently, IQ testing was remote from daily life and emphasized abilities of language and skill reflective of knowledge acquired from particular social or educational environments. Piaget developed the theory that human cognition based on an individual's effort to make sense of events going on in the world around him/her. An infant begins to make sense of the world through reflexes and then advances through symbolization, concrete operations and finally formal operations (Flavell, 1963).

Strengths of Piaget include the fact that he focused on children's actions and reasoning behind these actions and applied them to a common organized structure across mental operations. This structured set of operations allowed children to reason logically about anything. Weaknesses in his theory emerged decades later. Piaget failed to address memorized knowledge, or knowledge that is culture-specific. The belief that children can conserve by age three was not predicted or allowed by Piaget's theory. Even with these weaknesses, the undeniable strengths



made him *the* theorist of cognitive development. Piaget's theory is showing evidence of deficiency, but it may be the best we have (Gardner, 1983).

### Information-Processing Psychology

Following Piaget's theory of cognitive development, came a new concept called "information-processing psychology" or "cognitive science". This concept utilized methods developed throughout the century to manipulate tasks comparable to those performed by Piaget. The information-processing approach surpasses Piaget as it attempts to document every detail of all the strategies used by a child to process information including thoughts and behaviors. The goal of this approach was to be able to simulate the child's performance on a computer (Gardner, 1983).

Strengths of this approach include its dynamic view of the problem-solving process. This process is composed of the intake of information or access mechanisms, immediate and short-term retention before being encoded into the memory, and recoding and transforming operations on the newly acquired information. In addition, the higher-order thinking control mechanisms determine which problems, goals or operations should be applied and in what order. Limitations of the information-processing approach are that it lacks a theory which relates various forms of cognition. This approach has little or no connection with the operations of the nervous system, and does not take developmental changes into consideration. This theory requires more time to develop data to support itself (Gardner, 1983).

## Biological Foundations of Intelligence

The findings of brain and biological sciences bear two main issues. The first issue involves the flexibility of human development. The individual intellect can be altered by various interventions. One point of view considers development to be locked in, or alterable only in particulars. The other view permits developmental plasticity allowing individuals to explore different ranges and depths of capacity when appropriate interventions are applied at crucial times. Effectiveness and timing are important. The second issue is the identity, or nature, of the intellectual capacities that humans develop. One point of view states that humans possess general powers for information processing with unlimited uses. The opposite perspective says humans have a natural tendency to utilize specific intellectual operations while appearing incapable of demonstrating other intellectual processes. For example, nearly everyone has a capacity for language, but only few are musically or artistically capable (Gardner, 1983).

Plasticity and flexibility develop throughout life, especially during the early stages, and even then they are genetically influenced. It is speculated that humans are destined to use certain intellectual operations identified through careful observations and experiments. The educational system must accommodate for these intellectual tendencies at crucial times of development (Gardner, 1983).

## Multiple Intelligence Theory

Due to the nature of science, progression and regression, fit and lack of fit, there will

never be a list of human intelligence universally accepted or endorsed by all researchers. Even so, a better classification system of human intellect is needed to enable researchers to more effectively communicate and describe intellect (Gardner, 1983).

Gardner (1983) has established some prerequisites required for an accurate model of intelligence to be depicted. First of all, human intellectual competence must include problem-solving skills - allowing one to resolve problems encountered - and potential to find or create problems which lays the foundation for creating new knowledge. Intelligence must be useful and important at least in certain cultural settings. Another prerequisite for a particular type of intellectual functioning is the acute use of the sensory system. The comprehensive set of skills used by scientists or religious leaders are important, but do not qualify as intelligences as these roles can be broken down into collections of particular types of intellectual competencies. At the opposite end, psychologists testing for intelligence by asking for recall of nonsense syllables or unusual associations would not qualify as intelligences. These skills are not valued by a culture, but are a scheme used by the experimenters (Gardner, 1983).

Efforts have been made to nominate and detail various intelligences including Paul Hirst's seven forms of knowledge: Mathematics, physical sciences, interpersonal understanding, religion, literature and the fine arts, morals, and philosophy (Hirst, 1974). There is nothing wrong with these classifications as they may prove critical for certain purposes, however, they only reflect an individual's or culture's meaningful interpretation of various types of knowledge

(Gardner, 1983).

A prerequisite for the theory of multiple intelligence would include a complete range of abilities that are accounted for and valued by cultures. Gardner (1983) identified what he believed to be genuine and useful sets of intelligences by sampling a wide range of criteria or signs to be included in the ranks of the broader sets of intelligence. By using more of an artistic judgment verses a scientific assessment, eight "signs" of intelligence were identified. They are as follows:

1. Potential isolation by brain damage - ". . . to the extent that a particular faculty can be destroyed, or spared, in isolation, as a result of brain damage, its relative autonomy from other human faculties seems likely" (p. 63);
2. The existence of idiot savants, prodigies, and other exceptional individuals - by the display of uneven abilities and deficits within individuals;
3. An identifiable core operation or set of operations - the presence of one or more basic information processing operations, or mechanisms, which can deal with specific kinds of input;
4. A distinctive developmental history, along with a definable set of expert "end-state" performances - Normal and gifted individuals should have an identifiable developmental history which focus on the roles and situations central to intelligence. By identifying the timing and developmental milestones of intelligence, an analysis of individual

receptiveness to modifications and training is valuable to educators;

5. An evolutionary history and evolutionary plausibility - The specific intelligence becomes more credible by locating the evolutionary antecedents and capacities;

6. Support from experimental psychological tasks - Experimental tests can disprove or support that specific abilities are demonstrations of the same intelligences;

7. Support from psychometric findings - A supplement to experimental findings to identify whether one intelligence correlates with another;

8. Susceptibility to encoding in a symbol system - Although it is not necessary for intelligence to have its own symbol system (language, pictures, math), a characteristic of human intelligence may be a natural desire to be involved in a symbolic system.

This completes Gardner's criteria for judging a potential candidate to qualify as an intelligence (Gardner, 1983).

From this list, Gardner proposes at least seven different intelligences, or abilities of "talent". Following is a list and brief description with examples of Gardner's multiple intelligences in a non-hierarchical order:

1. Linguistic - sensitive to meaning and order of words (poet, translator);
2. Logical-Mathematical - the ability to handle chains of reasoning and recognize patterns and order (mathematician, scientist);
3. Musical - sensitive to pitch, melody, rhythm and tone (composer, singer);

4. Bodily-kinesthetic - ability to use the body and handle objects skillfully (athlete, dancer, surgeon);
5. Spatial - ability to perceive the world accurately and re-create or transform aspects of that world (sculptor, architect, surveyor);
6. Interpersonal - ability to understand people and relationships (politician, salesperson, teacher);
7. Intrapersonal - access to one's emotional life as a means to understand self and others (therapist, social worker) (Gardner, 1983; Hoerr, 1996).

Everyone possesses some degree of each intelligence. No two people have the same configuration. When solving problems or creating something, a combination of the differing types of intelligences are used. In order to excel in any field, it is essential to possess more than one intelligence. For example, a pianist must naturally possess musical intelligence as well as bodily-kinesthetic intelligence to be able to move his/her fingers skillfully across they keys (Hoerr, 1996).

Intelligences are not equivalent to sensory systems. They are not to be thought of in evaluative terms. Intelligences are sets of know-hows (Gardner, 1983).

#### Potential of Multiple Intelligence in the Classroom

Gardner's theory of multiple intelligences changes how we look at students and their potentials, which in turn alters an educator's role and responsibility. This theory focuses on the

nature of intelligence as it was intended for psychologists, not educators. However, the multiple intelligence model has been incorporated by educators as it allows the strengths of students to be seen in a different context (Hoerr, 1996).

Even though the multiple intelligence theory was not developed as a curriculum for an educational setting, it has great potential (Hoerr, 1996). Each school can implement its own interpretations of multiple intelligence which allows the theory to be culture-specific, context-specific, and school-specific. Students and teachers will benefit because the faculty works together to develop personalized individual strategies for their unique teaching situation (Hoerr, 1996).

Multiple intelligences are not to be confused with learning styles or to be used as a curriculum in and of itself. Learning styles, which will be discussed later, relate to other circumstances under which a particular student learns best. Learning styles, which may differ across activities, content area, etc., are related to the multiple intelligence literature. For example, for some individuals grammar may be best learned through memorization, but history may be best learned through the active recreation of historical events. Many investigators emphasize the importance of incorporating a variety of learning contexts in the classroom so students have the opportunity to learn best by using their individual learning strengths and intelligences (Fernald, 1943; Dunn & Dunn, 1978; Barbe & Swassing, 1979). Many educators believe lessons should utilize the processing and recalling of information through as many of the

intelligences as possible, however, it may be unrealistic to attempt to include activities addressing each intelligence within every lesson (Hoerr, 1996).

## Learning Styles

### Introduction and Background

Historically, when students struggle to learn, and do poorly on educational tasks, they were frequently blamed for not paying attention in the classroom. During the first part of the century, the blame shifted from the students' circumstances and conditions in which the students lived, i.e. crowded homes, poor nutrition, dirty environment, etc. Subsequently, variables such as low IQ, low socioeconomic status, and poor environmental stimulation were attributed to students' poor learning. One trend in today's culture is to place the blame on the teachers, instead of placing the responsibility on students, schools, and curriculum or methods used in the classroom (Dunn & Dunn, 1978).

Some students cannot be expected to learn by being placed in a traditional classroom using traditional methods. The individualness of each student's learning style must be considered and addressed before predictions can be made about how the student will learn most effectively (Dunn & Dunn, 1978).

Children with disabilities receive a diagnosis of their education as a result of Public Law 94-142. This law requires identifying individual techniques and styles of learning for a plan of individualized education (Dunn & Dunn, 1978). If handicapped students benefit from



individualized learning techniques, then undoubtedly all students, including those without disabilities, could also gain from a plan of individualized learning instruction. When individual techniques are considered, educators should focus on learner strengths rather than learner liabilities. Educators need to emphasize the strengths of the student - rather than focusing on limitations of the learner by attempting to correct or remediate deficit areas. Rather than expecting students to change their learning styles to adapt to the style emphasized by a teacher in a particular classroom, the teaching methods should be adapted to the students' individual learning styles (Flaherty, 1992). With this in mind, it is beneficial to understand the components of learning styles.

### Definition

Modalities, sensation, perception, and memory are the keys to learning. Flaherty (1992) defines modalities as the academic term for learning style. Modality is further defined as an individual's reception and retention of information through any of the sensory channels (Barbe & Swassing, 1979).

Sensations "... occur when an object or energy source from the environment impinges upon an individual" (Barbe & Swassing, 1979, p. 1). The stimulation from the object or energy source produces little or no meaning as it is only a pure interaction, or reception of a stimulus, between the individual and his/her environment. When meaning is applied to the sensation, it becomes a perception. The individual recalls past experiences of a specific sensation to attach

this meaning of perception. Perception could not exist without the memory where the information is stored. Two aspects of memory are utilized in the process of storing the information including the long-term and short-term memory (Barbe & Swassing, 1979).

Sensation, perception and memory are related to and dependent on each other. Sensation is the foundation providing the input for perception and memory. Without perception, the senses cannot be usefully organized. Some senses are ignored while other functioning senses are retained. The short- and long-term memory are responsible for retaining functioning of the senses (Barbe & Swassing, 1979).

### Perspectives of Modalities

Modality is more broad as it includes sensation, perception, and memory. Following are a few perspectives on the differing views of modalities. The first view is that modality is dependent upon heredity and fixed throughout the individual's life. When modalities are defined as fixed neurological components, they are characterized by sensation only which is located between the sensory organ and the area of the brain where the sensation is processed. For example, when children prefer the auditory pathway, they tend to remain auditory learners all their lives. This view does not consider environmental factors which are important influences of human behavior (Wepman, 1971). For this reason, this view is often rejected by educators and psychologists. Modality strengths may not be fully explained by its fixed characteristics, however, there is no doubt that a certain level of modality strengths are predisposed (Barbe & Swassing, 1979).

The second approach describes modality as a preference. Preference modality is an individual's perception of which modality he/she learns best with. Because the preference is based on personal experience, the modality is valid. However, reliability is questionable as an individual's judgment is likely to be inconsistent due to immediate situations of learning and the inability to carefully observe his/her own behavior across time. Most people are likely to give a socially acceptable answer or base it on an exemplary learning experience which may not be a true indication of their modality preference (Barbe & Swassing, 1979).

The first view fails to consider environmental factors. The second approach is unuseful due to the incapability of an individual to objectively observe their own behaviors. Barbe and Swassing (1979) suggest that modality is a measurable behavior. Their definition accounts for both heredity and environmental influences as well as the existence of modality preference. Modality strengths should be comprehensive and functional. Modality strengths are operationally defined "... as the ability of an individual to perform an academically relevant task in each of the major modalities" (Barbe & Swassing, 1979, p. 5). Heredity and environmental influences both play an important role in modality strengths as well as the existence of individual preference. Just because an individual is comfortable with a particular style, or modality, does not determine a consistent mode of receiving and processing of information (Barbe & Swassing, 1979).

Modalities are the pathways for reception and retention of information. Modality-based

instruction organizes instruction around one or more of these paths. Visual, auditory and kinesthetic/tactual modalities are most widely used in the classroom (Barbe & Swassing, 1979). Visual learners learn best by watching others do it and then writing down the steps or processes. These types of learners are described as being quiet and rarely distracted by noise. Auditory learners usually do not watch their teacher or take notes, as they are most likely to listen and remember. They are characterized as talkative as students who are easily distracted by noise. Kinesthetic/tactual learners learn best by direct involvement in the learning process. These students are often impulsive, lack patience, and are fidgety unless they can move about and "do" the learning (Silberman, 1996).

Kinesthetic learning is composed of many components including the sense of touch, large muscle movement and small muscle movement. Depending upon the circumstances, these abilities can be separated and treated individually or grouped together. Grouping them together is generally more beneficial due to few instances in the classroom where only one tactile sense is used or one large muscle alone is used. Each component is present in almost all children, but the relative mix varies for each child (Barbe & Swassing, 1979).

#### Dominant, Secondary, and Mixed Modalities

Typically, students fall into more than one category of modalities. As a result, most students can learn if a teacher provides a blend of the three activities (visual, auditory, and kinesthetic). However, some students struggle to learn unless teachers can provide a variety of

multisensory styles which attribute to the students' most efficient modality (Silberman, 1996).

The pathway through which an individual most efficiently processes information becomes his/her dominant modality. The dominant modality is easily observed in elementary age children, but becomes more integrated as children mature. A secondary modality steps up when a child does not learn under his/her dominant modality. The secondary modality complements and enhances the dominant modality, but is not as efficient as the dominant. Knowledge of the secondary modality is beneficial to a teacher who can present the material in this fashion when the dominant modality is not as efficient. Teachers who base their instruction on modality strengths help students reach their full potential and allow individuals to increase their rate of learning. Teaching through modality strengths is a logical approach as it does not make sense to teach an auditory learner the alphabet using flash cards when a tape recorded example would be more applicable (Barbe & Swassing, 1979).

### Modality Research

Little research support exists supporting the success of modality-based instruction. A review of fifteen studies over ten years by Tarver and Dawson (1978) reported the following: "In summary, the evidence indicates conclusively that modality preference and method of teaching reading do not interact significantly when we are concerned with actual methods of teaching reading and measures of recall or recognition." (p. 20).

Mills (1970), who developed the Learning Methods Test, reported that children learned to

recognize words more efficiently through different teaching methods and that no one method is best for all children. Mozingo (1978) found that elementary students with auditory preference were able to demonstrate better immediate and delayed recall of a list of memorized words when they were presented in their individual strongest modality.

Dunn and Dunn (1979) best summarize learning style effectiveness by stating that ". . . extensive observations and research verify significant improvement in both student achievement and motivation when learning and teaching styles are matched" (p. 242). However, there is a paucity of research and data to support these claims.

Teaching to modality strengths is presented in the literature as a simple concept which involves the teacher presenting the material in ways a child can best process and understand it. When information is presented in a way that coincides with his/her individual learning modality preference, mastery and recall of information are maximized. In most circumstances, it is not necessary to change the entire learning curriculum. With minor modification, any lesson can be adapted for any student to learn effectively (Barbe & Swassing, 1979).

### Modality Strengths in the Classroom

Once a modality strength is identified in a student, then the teacher can organize the curriculum using those strengths. As a result, the student has a better chance of succeeding and learning becomes more enjoyable for both the student and the teacher. Teachers should be aware of the following modality characteristics:

1. the modality through which each child learns best,
2. the modalities that are not effective for instruction,
3. the modalities that interfere with learning (Barbe & Swassing, 1979, p.15).

The first two are simple concepts, but the third is a little more complicated. Most children can comprehend the material when presented in multiple modality strengths by focusing on one strength or integrating the multiple strengths into one message. This is difficult for some children. Therefore, the teacher must be aware of students who struggle with parallel stimulation and identify these circumstances to make learning easier. This does not imply that teachers must use multiple modality strengths nor focus on only one. By having an awareness of all modality strengths, a teacher will have the foundation for an effective classroom. An awareness of necessary modifications will be made without forcing the teacher's personal strength upon the students to promote learning. In addition, when students struggle to learn, the teacher will be prompted to apply an alternative modality (Barbe & Swassing, 1979).

### History of Learning Styles

The teaching of reading and writing through auditory, visual, and kinesthetic modalities has been in existence since the pre-Christian Greece era. Oral communication was the methodology used to teach before writing existed. Following the development of writing, auditory methods were used to teach reading. The Greeks disapproved of writing as they feared the art of memorization would fade (Fernald, 1943).

The Romans used a visual-auditory method to teach reading by saying the words or letters while looking at a printed copy. During the seventeenth century, this method was used in the form of textbooks throughout England and the Colonies (Fernald, 1943).

Some kinesthetic methods used today date back to times before Christ was born. The Greeks taught by tracing a stylus or guiding the child's hand. Romans went beyond this to having the students trace letters that had been cut in wax tablets while learning the sounds. Eventually carved, or three-dimensional, letters were created and children could manipulate them while adults repeated the sounds of the letter (Fernald, 1943).

Even during these times, there was still a preference for auditory and visual methods based on memorization over the many kinesthetic methods available. Rote learning was dominating the mid-eighteenth century classroom through repetition and reliance on auditory and visual stimuli (Fernald, 1943).

The course of education was greatly influenced by three men. The first was a natural educational extremist Jean Jacques Rousseau. Rousseau based all knowledge on sensual experience. He focused on individual characteristics of the learner and stressed the importance of the actual process of learning verses what was actually learned (Kramer, 1976). Jacob Rodriquez Pereria was more practically engaged in the actual teaching process. Pereria particularly believed that the kinesthetic or tactile senses built the foundation for all other senses based on his work with deaf children (Kramer, 1976). The final influence on education was established by Etienne



Bonnot de Condillac. He believed the key to education was to direct and control the child's sensory experience and develop an individual instructional program based on each child's specific sensory characteristics (Lane, 1976).

During the end of the eighteenth century, the philosophies of Rousseau, Pereria and Condillac were put into practice in schools throughout Switzerland and Paris (Kramer, 1976). Johan Pestalozzi developed a school which trained the senses of impoverished and neglected children. Friedrich Froebel opened schools called kindergartens which utilized play to stimulate learning (Kramer, 1976). Jean Marc Gaspard Itard, a physician, relied upon kinesthetic and visual modalities to teach literacy to an unteachable child like the Wild Boy of Aveyron, who was a feral child found in the forest of France. Itard furthered his career by teaching deaf children through development of the senses. The process began with developing the kinesthetic or motor skills followed by tactile discrimination. Then visual, auditory and speech training were implemented. This final step was only applied once the stronger modalities were thoroughly trained (Itard, 1932).

### Montessori Instruction

The work of Itard was further applied by Maria Montessori. Montessori taught a variety of children, including the mentally retarded, emotionally disturbed, handicapped and poor, through physiology by educating the senses first and then the intellect (Kramer, 1976). She developed self-correcting materials which developed sensory and motor skills (Montessori,

1912). Student learning strengths were identified by watching the child engage in spontaneous play (Montessori, 192; 1914). Then the teacher could provide appropriate materials for the children which focused on these strengths and would result in spontaneous acquisition of pre-academic and academic skills (Kramer, 1976). Montessori's success made her an educational celebrity in Italy, eventually throughout the Continent and in America, but would fade out within five years of her death (Barbe & Swassing, 1979).

### Fernald Technique

Grace Fernald began her work in America as Montessori's methods were spreading across the Continent. Fernald (1943) developed an eclectic process involving the stimulation of all three approaches to education. This method was done by tracing a written word with the finger while saying it aloud. This process is repeated until the child can write the word without looking at the original. Once the child can read the word and has identified a meaning, the child reinforces him/herself by placing the mastered letter in a file box which also visually associates the word with its initial letter. This method worked for individual or small groups of children and adults with various reading abilities.

### Strauss-Lehtinen and Kephart

Modality-based instruction underwent an evolution during the late 1940's through the mid 1950's. Strauss and Lehtinen (1947) played a key role with their practice of limiting distractions, use of motor activities and the focus on independent work in brain-injured children's education.

Kephart (1960) was another contender during this time period. He proposed that by manipulating sensory motor or perceptual motor skills, the child could adapt his behavior to meet the demands of the changing environment.

### Illinois Test of Psycholinguistic Abilities

Special education has always been at the center of modality-based education, especially with learning disabled children. With this in mind Samuel Kirk developed the Illinois Test of Psycholinguistic Abilities (ITPA) to identify perceptual based problems of language, reading, and writing. Once the problem was identified, methods of remediation were developed using each child's perceptual strength (Kirk, et al., 1961; 1968).

### Frostig's Program . . . Visual Perception

Following the development of ITPA, Marianne Frostig published a program to assess components of visual perception. As a corrective and preventive device, this program reflected Frostig's belief that vision was the most important modality (Frostig & Horne, 1964). Assessing only the child's deficits was a downfall for her program. However, unique aspects of her program included the development of a simple means of assessing the components of visual perception, and the interventions could be applied in the classroom as well as in the home (Barbe & Swassing, 1979).

### Further Developments of Modality-Based Instruction

Modality-based instruction was very common with special populations, and by the 1970's,

it was beginning to enter into the general educational environment. This movement was supported by the R. E. Mills' publishing of the Learning Methods Test (1970), the introduction of the Swassing-Barbe Modality Index (1979), and the building of Rita and Kenneth Dunn's Learning Style Inventory (1975b).

### Lack of Modality-Based Instruction in the Classroom

If modality-based instruction is so beneficial, then why is it not incorporated in more classrooms? First of all, there appears to be a sense of superiority when a child can recite information from memory when he/she has been taught auditorally or visually. When these methods fail, then educators turn to the kinesthetic modality. This attitude may have developed when word of mouth was the only means to transmit information between people, and rote memory was an important factor for the continuance of the species (Barbe & Swassing, 1979).

The second factor is that modality-based education has the implication of being remedial. It has been primarily used in special education, even though results have been observed with both handicapped and normal students. The principles of modality-based education have struggled for acceptance (Barbe & Swassing, 1979).

Another factor is the limited availability of materials to assess individual modality strengths. Observation was the primary protocol, but no guidelines were established for the common person to learn the techniques. The tests designed by Fernald (1943), Strauss and Lehtinen (1947), and Kephart (1960) were limited to licensed psychologists, therefore omitting

classroom teachers. Kirk's ITPA (1961; 1968) involves extensive time and training to properly administer. Frostig's (Frostig & Horne, 1964) assessment considered only the visual component and was deficit oriented. Even though Mills' Learning Methods Test (1970) is appropriate for the classroom, its value is limited due to the extensive amount of time required for administration. Using a modality-based approach is impossible without practical means to assess individual perceptual strengths (Barbe & Swassing, 1979).

Finally, relatively few curriculum exists for teaching to modality strengths other than the Rebus Materials, Spalding Instruction or that of Maria Montessori. Most attempts at teaching to sensory strengths have focused on remediating specific deficits or teaching individual skills. No systematic framework has been designed or investigated for helping teachers address and incorporate activities in a variety of ways emphasizing differing learner modality strengths within their daily activities (Barbe & Swassing, 1979).

### History of Identifying Modality Strengths

The goal of educational testing is to identify a child's strengths so the teacher can present the material in ways in which the child is most likely to be successful. Unfortunately, it seems that most testing in the United States has been designed to identify and find weaknesses, deficiencies, problem areas or limitations of the child (Barbe & Swassing, 1979). The earliest forms of testing for learning styles were done through observations. Observations yielded important learning characteristics for the best educational applications for a particular child. The

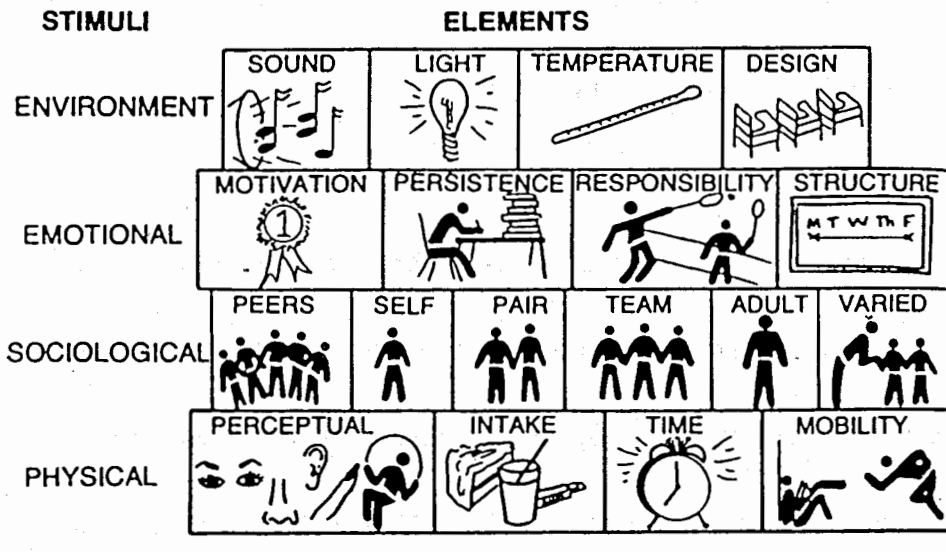
observational movement was prompted by Rousseau and Condillac during the mid-eighteenth century (Kramer, 1976). Itard (1932) then made the first practical application using this method to instruct Victor, the *enfant sauvage*. Itard made observations, reviewed others' observations and developed activities which incorporated all of the senses, particularly the kinesthetic, to teach Victor to be civilized and literate. Montessori (1914) also stressed the importance of observation.

Seguin was the first to develop structured activities to identify modality strengths within the individual. By the end of the nineteenth century, Binet and Simon developed a procedure to identify students struggling in public educational settings. Simple tasks were used to identify modality strengths. However, the tests lost much of their value when test makers changed them into tests of intelligence, implying that a person's intelligence is identified by a fixed score rather than indicating learner modality strengths. In the 1960's the ITPA (Kirk, et al., 1961; 1968) was the first instrument designed to identify intraindividual differences regarding how one best processes information. The results can be beneficial in identifying learner strengths and deficits regarding the processing of information, however, the ITPA is of little practical use to administrators and requires a lengthy amount of time to administer (Barbe & Swassing, 1979).

Rita Dunn was asked to direct a graduate program which assisted teachers to develop strategies to help teach students who had not responded well to traditional teaching. It was soon discovered that some methods were highly effective for some students, and not at all effective for others. Some students benefited from small-group techniques while others tried to avoid them

altogether. Some became bored and fatigued with the nontraditional orientation while others would sit for hours using the same technique. It was obvious that if students were to become academically successful, effective techniques for each individual would have to be identified and incorporated into the educational milieu. This seemed to hold true across curriculum domains. Each student learned and processed information in differing ways and a "one size fits all" orientation was abandoned (Dunn & Dunn, 1978).

### Diagnosing Learning Style



Designed by Dr. Rita S. Dunn  
Dr. Kenneth J. Dunn (1978)

Figure 2 Eighteen elements of learning style  
Research emphasized by Dunn and Dunn has indicated that learners may be affected by four different types of stimuli composed of eighteen categories or elements (see chart above) (1975). The first stimulus is the immediate environment including sound, light, temperature, and design. The second stimulus is the emotional component of the learning environment which

includes motivation, persistence, responsibility, and structure. The sociological needs of a learner include the ability to work with peers, self, pairs, teams, adults, or a varied approach and composes the third category. The final stimulus is physical needs of the student. This includes elements of perception (sight, smell, hearing, touch, and motor skills), intake, time, and mobility (Dunn & Dunn, 1975a).

According to Dunn and Dunn (1978), it is important to understand the definitions and implications of each element involved when attempting to identify components of individual learning styles. The first stimuli, environmental factors, includes four elements. The first element of sound may not be a factor for some students as they may be able to block it out. Some students require a relatively quiet environment, some need absolute silence, while other students struggle to learn effectively in an environment void of auditory stimulation. Some students prefer best if there is background noise from a television or radio blocking out extraneous sounds. Research indicated that the majority of students are relatively unaffected by the second factor of light in comparison to other categories (Dunn & Dunn, 1978). However, lighting is still important for a few students who are over-sensitive to light or require high intensity lighting for optimal learning conditions. The third factor is temperature. The literature suggests that some students concentrate better when they are in cooler environments because they have a tendency to become drowsy in warmer environments. On the other hand, it has been noted that some students need warmth to effectively concentrate and become uncomfortable when the temperature is reduced. The final



environmental influence addressed by Dunn and Dunn (1978) is the design of the classroom. Investigations indicate that some students prefer an informal relaxed and casual environment with a couch or cushioned chair to most effectively concentrate. For others, a relaxed environment elicits behaviors incompatible with optimal learning. These students are more productive in a more formal environment sitting on a hard chair or with a well organized desk in front of them. In summary, Dunn and Dunn suggest that some students may be more comfortable learning while lying on a carpet while others need the traditional classroom structure with a desk. The design of the classroom should not be of major importance, as long as students are actively learning. To be effective with learners who approach tasks and process information in diverse ways, classrooms should incorporate a variety of environments to enhance learning effectiveness for all students (Dunn & Dunn, 1978).

The second stimuli, emotional factors, also consists of four elements. The first element is motivation. Motivated students are students who want to learn and do so simply by being told exactly what is required to do, what resources are available, how to get help, and the expectations of how to demonstrate what they have learned. Unmotivated students, on the other hand, must be given short assignments with resources to complement perceptual strengths. For example, if they are auditory learners, they should be given a book with a cassette which reads aloud to them (Dunn & Dunn, 1978). Then these students can complete a task, behave positively, and become more capable of completing an assignment. The second element is persistence. Some students

will work until a task is completed. If there is a problem, they may ask a peer, find another source, or ask the teacher. Other students with short attention spans who struggle to work for long periods of time, should be given different objectives with varying lengths and types of assignments. For example, students who struggle with persistence should be given simple objectives with a time limit. Breaks should be allowed as long as the assignment is completed on time (Dunn & Dunn, 1978). Responsibility consists of the student following through until a task is completed with little supervision. This requires an understanding of the assignment, available resources, time frame, and where to go for help. Irresponsible students become easily discouraged and irritated when tasks become too difficult, and may result in disturbing the class. It is important to identify how these students will learn best and apply methods that match their style of learning. Once they become successful and can see that they can achieve, assignments may be lengthened or be slightly more demanding. Teachers should expect responsible behavior, and encourage it, but remain cautious about demanding more than what the student is capable of achieving. The final element of emotional needs is structure. Some students require well-defined instructions and procedures while others become frustrated when they are not allowed to be creative and organize their own studying situations with options and choices. The type and amount of structure should vary for a classroom to be more effective (Dunn & Dunn, 1978).

Sociological elements are the third stimulus. This involves the student's capability to learn alone, with peers, in pairs, or with a team. Some students may require the presence or absence of

an adult or authority figure. Many possible variations are in existence (Dunn & Dunn, 1978).

The final stimulus affecting learners is the physical elements. The first component is the perceptual strengths which involves the students' abilities to learn through the different senses including auditory, visual, tactual, kinesthetic (real-life experiences or whole body involvement) or a combination of the senses using a variety of resources. Students who struggle with learning or are learning disabled should be taught through multisensory activities. Some learners appear to require an intake of some sort (nibbling, drinking, smoking, or chewing gum) while they concentrate continuously on a particular task. Students who bite their fingernails or chew on pencils while concentrating may be indicating a need for intake. Time of day may have an influence on some students' ability to learn. Some students may function more effectively in the morning while others think more clearly in the afternoon or evening. Mobility is the final component. Students who are fidgety, restless or get out of their seat often may require mobility in order to learn effectively. Some students are capable of completing tasks while remaining in one position or location, but others need to move around while they are learning (Dunn & Dunn, 1978).

Children with mixed preferences of learning styles are more efficient in the classroom because they are able to use more than one modality to process information (Barbe & Swassing, 1979). Teachers can grasp the attention of more of their students with the application of a variety of strategies. Doing so allows the teacher to tap into each student's dominant, secondary, or

mixed preference of learning. By doing so, the students' preferred learning style is reinforced and the weaker ones are strengthened. Teachers may contribute to students' inattention and disruptive behaviors when using only one modality (Tucker, Shearer, & Murray, 1977).

### Identifying Learning Styles

There are many ways in which people reveal their preferred style of learning. Students may be able to define their own preference (Dunn & Carbo, 1981). Inventories can be given to students by teachers to identify learning styles (Dunn & Dunn, 1978; Barbe & Swassing, 1979). In addition to inventories, learning styles may be efficiently identified by observing the students' eye movement and listening to their usage of verbs (Bandler & Grinder, 1979; Barbe & Swassing, 1979; Baron, 1979; Dilts, 1979).

### Eye Movement Observations

A person switches from external to internal processing when they look away after they have been asked a question. Studies indicate that when information is being processed, one can identify which hemisphere of the brain becomes activated by observing eye movements. For example, when a person shifts their eyes to their left, the right brain becomes activated and vice versa (Huang & Byrne, 1978; Richardson, 1978; Weed & Ryan, 1982).

While there are individual and other differences in the relationship between eye movement and cognitive preference, eye movements follow a meaningful pattern that is consistent in approximately seventy to eighty percent of the time for the ninety percent of the

population who are right-favoring (right-handed people and the left-handed who write in a hooked position). About eighty percent of right-favoring people channel visually by looking up, auditorally by looking to the side, and kinesthetic/tactually by looking down. They look to the observer's right (their own left) when remembering information and to the observer's left (their own right) when projecting or constructing information. Left-favoring individuals also followed upward, sideward, and downward patterns - the sides they use for recall and construction are the opposite of those used by those who favor the right (Gur & Reivich, 1980; Bandler & Grinder, 1979; Dilts, 1979).

How people utilize verbs may also signify their learning preference. A student's response to the question of "Do you understand?" may indicate learning preference. For example, students with visual preference, tend to respond using visual words referring to sight like "I see!" "I hear you loud and clear!" may be a phrase heard from auditory learners when they are asked the same question. Auditory learners are likely to use verbs like say, ask, or hear, relating to the ear and hearing. The kinesthetic/tactual learner's verb usage implies movement and feeling. "I've got it!" may be a phrase they would use as their vocabulary may include verbs like do, make, pull, or feel. When teachers speak to students through the students' preferred learning channel by using these corresponding verb patterns, results may show improved communication, building of rapport, and increased learning (Bandler & Grinder, 1979; Barbe & Swassing, 1979; de Lorenzo, 1980).

## The Learning Style Inventory

Dunn and Dunn (1978) developed a questionnaire to identify how students preferred to learn. Their research had demonstrated that learning styles could be self-identified. Students scored higher on tests and were more efficient when they were exposed to teaching styles parallel to how they preferred to learn compared to students who were taught using methods other than their preferred learning style. This instrument was tested and revised over the next five years accumulating empirical data, reliability and cosensory validity. In 1974, Gary E. Price conducted a content analysis of each item on the questionnaire and included only those items with ninety percent accuracy or better on a new form. This shortened form became known as the Learning Style Inventory (LSI) and achieved reliability as well as face and construct validity (Dunn & Dunn, 1978).

The LSI uses a comprehensive factor analysis to identify a student's learning style within the eighteen elements of style. The LSI takes thirty minutes to complete and is appropriate for students in grades three through twelve. The LSI not only provides information of the student's preferred learning style, but also suggests how to design environmental and instructional strategies to benefit that particular student. Data obtained from the LSI allows teachers to group students with identified similar styles and place them in appropriate environments which meet their needs. The LSI also aids in the identification of materials that would appeal to students with particular learning styles (Dunn & Dunn, 1978).

The LSI has students self-report their personal learning styles by answering one hundred four true-false statements. Administrators must be warned that by using this method, modality preferences may be identified rather than modality strengths (Barbe & Swassing, 1979).

### The Swassing-Barbe Modality Index

The Swassing-Barbe Modality Index (SBMI) is a tool used to identify all modality strengths (not preferences) and requires minimal amounts of training and time for administration. The SBMI is a matching-to-sample task where a sample item is presented, and the subject is asked to reconstruct the sample. This assessment takes approximately fifteen minutes to administer. It can be applied to subjects in preschool through adulthood. Another advantage of this assessment is that because shapes are used, it can be used for children who can not read or for children whose first language is not English (Barbe & Swassing, 1979).

Each modality is tested by using a sample which is composed of various sequences of shapes (circle, square, triangle, and heart) increasing in length. The visual modality is assessed by having the subject see a pattern and then matching it to the sample. Auditory strengths are assessed by hearing a pattern and matching to to the sample. The kinesthetic learner is identified by having him/her feel a pattern and then matching it to the sample. The strongest modality is identified as the one in which the subject performs most efficiently. A percentage score is identified for each modality. The teacher should also observe and take notes on the child's behavior during the assessment to provide clues about their preferred modality. For example,

visual learners may space off to black out visual distractions, while auditory learners may mouth the shapes to themselves or aloud. The kinesthetic learner may use their hands to help them remember the sequences (Barbe & Swassing, 1979).

### Matching Learning Style with Instruction

Once a student's learning style has been identified, it is important to match the methods and styles to the resources which will most benefit the student. Students are grouped in academic programs. Four main programs exist including the traditional, individualized, open and alternative. Each program accommodates different learning styles of the student and teacher. If a teacher decides to implement a particular program, students assigned to his/her class are automatically involved despite the fact that this particular program may not be appropriate for the students' learning needs. In contrast, the student assigned to teachers who do not initiate a varied approach will automatically be instructed in a traditional classroom environment. Neither extreme is beneficial unless the program matches each students' individual learning style. Some teachers apply their own program of instruction which incorporates features from several of the programs (Dunn & Dunn, 1978).

The first type of instructional program is the traditional classroom. In this program, the teacher is responsible for helping the students achieve grade-level standards. Assuming that each child will learn through the teacher's selected method, students are expected to pay attention, take their work seriously and behave appropriately. The teacher's lesson plans demonstrate the use of



lecture and questioning with an occasional addition of media sources. Students learn the same teacher-selected content at the same time and are evaluated through group tests (Dunn & Dunn, 1978).

An individualized classroom is the second type of instructional program. In this program, each child's learning is diagnosed, prescribed, and individually guided by the teacher. As long as students continue to demonstrate that they are indeed learning, they are allowed to work anywhere in the classroom in any sociological pattern. As success continues, more options are allowed. When students fail to succeed under these conditions, the teacher adds structure and direct supervision utilizing available multimedia, multisensory resources. Students contribute to the development of their individually written objectives. The level of achievement for each objective is determined by criterion referenced testing (Dunn & Dunn, 1978).

The third type of instructional program is the open classroom. This program allows children to select their own curriculum, resources, schedule, and pace of learning. Students can choose any sociological environment and remain with a topic as long as it interests them. The teacher provides an environment full of multimedia resources and encourages the students to utilize the materials. If objectives are used, they are individually determined by the child and continuously changing. Evaluations, not grades are used to determine the individual growth. A positive, upbeat environment is important for student progress (Dunn & Dunn, 1978).

The final type of instruction is the alternative program. Students are independently

expected to gather and retain information as they are given curriculum choices, freedom, and objectives when developing their program. Because of the wide variety, the options of objectives, resources, activities, and evaluations depend on the individuality of the program, not the student (Dunn & Dunn, 1978).

From the previous descriptions of instruction, one can see that certain environments are appropriate for some students but inappropriate for others. Each program will be beneficial for some students as each individual learns differently. No program can be made to accommodate each and every learning style, but if a student is placed in a program inconsistent with his/her ability, he/she will not progress as efficiently or effectively (Dunn & Dunn, 1978).

Due to the large variety of learning styles and the endless combinations of environmental stimuli, it may be extremely difficult to accurately diagnose an individual's learning style. In addition, various learning styles may be utilized under specific circumstances or situations. Therefore, it is important to apply a variety of learning styles and environmental elements in order to accommodate each student's needs. As more modalities are offered in the classroom, students are more likely to use their modality strengths to learn more effectively and efficiently.

### **Aptitude Treatment Interaction**

#### **Definition and Introduction**

Aptitude treatment interaction theory relates individual differences in aptitude, including cognition and affective style, with instructional method. Aptitude stresses the variability of traits

among individuals (Keefe & Ferrell, 1990). Aptitude and learning style are often used interchangeably. Learning style is a type of aptitude treatment interaction (Jordan, 1993).

"Aptitude treatment interaction suggests that a person's distinctive characteristics or aptitudes can be matched to a specific treatment (instructional method with a more effective outcome) than could otherwise be achieved." (Snider, 1990, p. 53).

The aim of education is to provide alternative instructional treatment to fit the major differences in aptitude among students. The goal is to take advantage of the most crucial aptitudes while avoiding the weaker aptitudes. For students deficient in the alternative instructional treatments, their learning skills and strategies would be built up (Snow, 1984).

#### Research in Areas of Learning Style and Aptitude Treatment Interaction

Brunner and Majewski (in Jordan, 1993) used the LSI to form the instructional foundation for mildly handicapped students in nine through twelfth grades in New York. Instruction was then provided through the individual's primary perceptual strength, and reinforced through his/her secondary and tertiary strength incorporating the elements identified in the LSI. In 1987, prior to the program, only twenty-five percent passed the tests required for a diploma, but during the first year of the program, sixty-six percent passed the exams. Students involved in the program surpassed the regular education students during 1989-1990 as they achieved ninety percent on the tests.

A similar study by Perrin (1990) administered the LSI to potential dropout high school

students in New York who had just completed ninth grade. At the end of tenth grade, only one student had dropped out. Those remaining in the project had increased their GPA scores from means of four to eighteen points across four subjects. Participation in the project continued throughout eleventh grade and more than fifty percent of the participants applied for college.

The previous examples are typical studies relating learning style preference and perceived student achievement. The research revolves around a particular school or grade, is short-term, and uses a single means of assessment. There is inadequate support that matching instructional strategies to learning preferences is the sole reason for the outcome. One must question whether the results are consistent over time, across populations, across other classrooms with other learning strategies, and environmental adaptations (Jordan, 1993).

Other studies focus on only one aspect of learning styles. Dunn and Griggs (1988) saw New York students' scores on the Iowa Test of Educational Achievement increase from 8.5 to 10.5 from one year to the next by manipulating only the preference of time of day for administration. Dunn (in Jordan, 1993) also administered the Iowa Basic Skills Test to elementary students in Kansas while manipulating the time of day and seating design during the testing. The students achieved statistically higher reading and math scores.

Elementary students from a low socioeconomic population in North Carolina had reading and math scores in the thirtieth percentile in 1986. After one week of applying the Dunn learning style model, scores on the California Achievement Test jumped to the fortieth percentile. Scores

reached the eighty-third percentile by 1989. It was pointed out that the only factor contributing to these gains was the introduction of the model of learning styles (Dunn, 1990).

While contemplating the research about aptitude treatment interaction, certain conclusions may be drawn. First of all, most of the research is composed of reports from a single school. Second, little is known about achievement over time, due to the young age of the field. Third, prospects are limited for comparison across groups as most reports involve only one class, or one or two subjects. Fourth, the lack of control groups restrict opportunities to evaluate the actual worth of the learning style models. Finally, the independent and dependent variables are usually not firmly established. However, even with these weaknesses in research designs, most teachers, students, and parents are enthusiastic about applying learning style preferences. They believe that it often makes a dramatic difference in achievement and self-confidence among diverse populations of students (Jordan, 1993).

### **Active Learning**

#### **Characteristics of Kinesthetic Learners**

Barbe and Swassing (1979) propose that thirty percent or more of students may have a kinesthetic/tactual preference for learning. Who are the kinesthetic learners? They are the active students who are most likely to do it first and read about it later. Teachers, who prefer students to study or read and then act, often consider active learners to be impulsive. Of the four types of learners (kinesthetic, auditory, visual and tactile), kinesthetic learners are least likely to read for

pleasure. They read to get meaning. For example, they may read the instructions on how to assemble a model car. They are more likely to excel in sports as they would rather be active and moving around than sitting and reading a book (Flaherty, 1992).

Many kinesthetic learners also display one or more of the following traits: Illegible cursive handwriting, stand too close while conversing, poor test taking abilities (even though they often appear to know the material), and have a talent for hands-on projects in school (Flaherty, 1992). Other characteristics of kinesthetic/tactual learners are that they fidget with objects or ideas by trying them out, touching, feeling or manipulating them. They may physically express their feelings by jumping for joy, pushing, stomping, or pounding. Kinesthetic/tactual learners often use their hands when speaking, do not listen well, and lose interest quickly in lecture-type environments. Initially, they appear neat and tidy, but because of activity and involvement, they soon look disheveled (Barbe & Swassing, 1979).

### Struggles of Kinesthetic Learners

Auditory and visual learners tend to be the brighter students in the class as most classrooms cater to these styles. Naturally, the auditory and visual learners are going to retain the information and do well on tests which are usually administered in an auditory or visual fashion, once again catering to these types of learners. On the other hand, students who appear to be struggling in school tend to be tactual or kinesthetic learners (Dunn, 1971; Dunn & Dunn, 1978a; Dunn, Dunn, & Price, 1976; Dunn, Dunn, & Price, 1977). The tactual or kinesthetic learners

benefit from hands-on or manipulation of items where they can have "real-life" experiences.

They do not perform well under auditory or visual conditions. Unfortunately, most classrooms do not incorporate tactual or kinesthetic methods into the instructional techniques. As a result, the tactual and kinesthetic learners fall behind scholastically (Dunn & Dunn, 1978).

When children are younger, many of them appear to be predominately tactual or kinesthetic learners. Over time, many students will combine their tactual abilities with visual or auditory styles so they can function more efficiently in the classroom. Unfortunately, not all students are able to adopt a second learning style. Learning becomes extremely difficult for primarily tactual and kinesthetic students beyond early elementary years. After the early elementary grades, most learning/teaching is presented using auditory and visual approaches.

When students are unable to learn using auditory and visual methods, it is important to test their individual learning style and experiment with materials which will complement their strengths of tactile or kinesthetic styles (Dunn & Dunn, 1978).

Materials designed for tactual and kinesthetic learners are usually game-like and naturally motivating. Students should enjoy them, and as a result they will persistently use them until they have achieved their outlined objectives. The materials are also self-corrective with little structure. The materials work best for students who struggle to learn by listening or reading and benefit the visual-tactile, tactual-kinesthetic, and visual-kinesthetic learners. Tactual and kinesthetic resources can be adapted to accommodate each child's environmental, physical and

sociological needs (Dunn & Dunn, 1978).

Active learning is not just "fun and games". Although learning can be fun, active learning strategies provide challenges requiring much hard work. An active learning experience followed by reflection and discussion are valuable tools to reinforce the concepts one is trying to teach. Active learning does require more time than lecturing, but when content is kept moderate, teachers can apply and reflect on the activities to reinforce what is being learned. Active learning motivates students to learn boring material as they become excited about the activity. Active learning should be fun and challenging. The classroom's physical environment plays an important role in this process (Silberman, 1996).

Providing information does not automatically stimulate learning. Learning requires mental involvement and doing- not explanation and demonstration alone. For learning that is long lasting, it must be active (Silberman, 1996).

What does it mean to be an "active learner?" Active learners are students who use their brain to study, solve, and apply what they learn in a fast-paced, fun, supportive and personally engaging environment. This usually involves moving around out of the seat and thinking aloud. In order to learn well, it helps when students are able to hear, see, ask questions, discuss and most importantly "do it" by figuring things out for themselves (Silberman, 1996).

Silberman (1996) has modified and expanded the wisdom of Confucius stressing the need for active learning through what he calls the Active Learning Credo:



"What I hear, I forget.

What I hear and see, I remember a little.

What I hear, see, and ask questions about or discuss with someone else, I begin to understand.

What I hear, see, discuss, and do, I acquire knowledge and skill. . . ." (p. 1).

Piaget, Montessori, and others proposed that children learn best through concrete, activity-based experiences. Even teachers not promoting active learning, know that children struggle to sit still for long periods of time and have a short attention span. As a result, teachers attempt to keep children active and moving around (Silberman, 1996).

### Lectures verses Active Learning

Why do students tend to forget what they hear? Teachers speak one hundred to two hundred words per minute, but students listening attentively are likely to hear only fifty to one hundred words per minute. Thinking continues while listening, and it becomes difficult to concentrate for extended periods of time. If teachers talk slower, students get bored and minds begin to wander (Silberman, 1996).

The brain does more than receive information. It processes the information by recalling the familiarity of the information, where it fits in with previous knowledge and how it applies. The brain functions better when it can ask questions and discuss the information. When students are allowed to discuss what they have learned, nerve networks are solidified and internalized

through the movements of the face, tongue, eye muscles, and all properties in the face. As more parts of the body are activated in the learning process, retention is likely to increase (Hannaford, 1995). One study showed that students who were allowed to frequently discuss the information presented by their teacher received two letter grades higher than students in a control group prohibited from discussion (Ruhl, Hughes & Schloss, 1987).

A study by Pollio (1984) showed that college students were not attentive forty percent of the time during lectures. During the first ten minutes of a lecture, students retained seventy percent of that they heard compared to only twenty percent retention during the last ten minutes of a lecture (McKeachie, 1986).

Several problems arise when a teacher chooses to lecture. First of all, with each minute that passes, student attention decreases. Lectures are geared towards auditory learners. Lectures promote lower level learning of factual information. Lecturing assumes that all students learn the same information at the same pace. Finally, lectures are unappealing to most students (Johnson, Johnson & Smith, 1991).

Providing auditory and visual stimulation reinforces what is being taught and has a better chance of reaching several types of learners. Pike (1989) reported that when teachers added visual materials to their lectures, student retention increased from fourteen to thirty-eight percent. This indicates that as more learning styles are applied, learning and retention are likely to improve.

Active learning requires student participation. Lecturing alone will not lead to effective learning if used too often, but can be effective at times. In order to be effective, teachers must create an interest, maximize understanding and retention, get the students involved in the lecture and reinforce the material. Creating an interest can be achieved by beginning the lecture with a story or an interesting visual aid. Using headlines, examples and analogies supported by visual aids will maximize understanding during the lecture. For example, the teacher might challenge students to give examples, spontaneously ask quiz questions, or use brief activities to enhance main points. The material can be reinforced by having the students review with each other, administering a review test, or providing a situation or problem for students to apply what they have learned (Silberman, 1996).

### Goals of Active Learning

Three goals should be accomplished during the initial stage of active learning. The first goal is team building. Team building helps students become acquainted with each other, creates cooperation and interdependence. The second goal is to apply on-the-spot-assessment to learn about student attitudes, knowledge and experiences. The final goal is to immediately get the students involved in the learning by creating interest in the topic. Accomplishing these goals will assist in promoting student involvement, increase their desire to participate in active learning and implement positive classroom norms. Active learning may also minimize behavior or management problems often observed in classrooms which rely too heavily on lecture or group

discussion alone (Silberman, 1996).

The purpose of education is to acquire knowledge, skills, and attitudes. Cognitive learning, or knowledge is achieved through comprehension, analyzation and application of information and concepts. The ability of students to competently perform tasks, solve problems and express themselves is obtained through the development of behavioral learning, or skills. Attitudes, or effective learning requires the examination and clarification of feelings and preferences (Silberman, 1996).

The way in which a student is exposed to learning is important. There is little mental engagement during passive learning. When something happens to the learner, there is a lack of curiosity, questioning and interest. However, the active learner is seeking out the answer to a question or trying to find information to solve a problem or complete a task. Active learners desire to seek out and obtain this information for task completion (Silberman, 1996).

Students have a better chance of understanding when learning is active. Retention rates increase when time is taken to consolidate the learned material by reflecting on it and giving emotional closure. This closure can be acquired by using any of the following: Reviewing the strategies or recalling what they have learned; helping students self-assess, or evaluate their progress by what they know now, can do now, and the attitudes they have now; encourage learning to go beyond the classroom by helping students use what they have learned; and by bringing closure as students reminisce about their experiences. By having students review the

material, retention is five times greater than material not reviewed. Review gives students the opportunity to reconsider the information and store it in their brain (Silberman, 1996).

### The Body as a Learning Instrument

Hannaford (1995) states that ". . . learning, thought, creativity, and intelligence are not processes of the brain alone, but of the whole body." (p. 11). Our brain is in constant communication with our entire body. While teaching, educators are likely to only focus on the brain as they try to shape and develop it. The body is treated as if it is only used to transport the brain into new learning environments. The body has an important role in all intellectual processes throughout life. The senses feed and stimulate the brain's information from the environment. Therefore, learning does not just occur in the brain. The entire body becomes an instrument of learning as we move about activating neural wiring throughout the body (Hannaford, 1995).

Neural plasticity in the nervous system gives us the ability to learn. As we grow, move, and learn, our cells connect and form neural pathways. This organization occurs in response to stimulation and activity. As we interact more with the world, learning continues through communication with the neurons. The communication process continues with the development of dendrites, nerve cells, and pathways. These pathways allow access to the world and allows individuals to act upon it. Learning and thought are taking place as a result of the nerve cells connecting and networking. Associations can be made, information is synthesized, and the

system is continuously organizing itself in complex ways (Hannaford, 1995).

The two hemispheres, or right brain and left brain, develop and process information differently. We function more intelligently when we access both hemispheres. For maximum proficiency, it is necessary to use both hemispheres in a balanced manner. Both sides of the body are working evenly to coordinate movements of eyes, ears, hands, feet and balanced core muscles. When all of these body parts are used equally, the corpus collosum, which is in charge of the processes between the two hemispheres, becomes more developed. Learning becomes easier as the cognitive functioning increases due to the activation of both hemispheres. Learning is bound to be more engaging and successful when learners and teachers take full advantage of the brain's capabilities (Hannaford, 1995).

When children are about five years old, they access gestalt functioning. Between ages four and seven, the gestalt hemisphere begins to develop and grow, while the logic hemisphere begins to enlarge at seven to nine years (Coulter, 1986). For children starting school, usually five to six years old, the most natural way to learn is through image, emotion and movement. Usually children entering kindergarten have wonderful imaginations and a large vocabulary. Alphabet and number recognition are immediately taught in the curriculum, followed by reading. If we used image, emotion and movement to build on the students' imagination and vocabulary, learning might be more efficient. However, most curriculum involve teaching the student to "sit still" while learning letters and numbers in a linear fashion, and reading books with simple

vocabulary, no emotion and limited images (Hannaford, 1995).

Hannaford (1995) personally recalled learning the alphabet by singing the alphabet song while physically making letters using her body. She was able to make a connection through singing and movement. Today, she still catches herself singing the song when she files papers alphabetically.

Real learning, when the learner makes meaningful connections, is not complete without the output of physical, personal expression of thought. Skills allowing the expression of knowledge like speaking, writing, drawing, and graceful movements in sports and dance, complement the knowledge we have. These skills develop using muscles which establish neuromuscular routes and their ties to cognitive routes. Learning does not take place only in the head. An important ingredient of learning is the active, muscular expression of learning. Muscles are usually correlated with the body, not the mind. Understanding is advanced and solidified through expression. This expression is usually seen through speech or writing which indeed integrates knowledge and facilitates thought. However, humans are capable of other means of expression and integration like drama, art, or sports. Many domains of knowledge are expressed with skilled muscle coordination in athletics. For example, knowledge of space and time as well as human dynamics like teamwork, motivation and goal setting are expressed through athletic movement (Hannaford, 1995).

## Movement

"Movement awakens and activates many of our mental capacities" (Hannaford, 1995, p. 96). An individual's first sense of the world, as well as knowledge and experience with gravity, occurs with movement in the womb. With every movement made, a sensory-motor event occurs which links to the understanding of the physical world. All new learning is obtained from the physical world. Moving the head aligns the sensory organs to the environmental stimuli. Minute movement of the eyes allows one to see at a distance or focus on the words on this page.

Touching and manipulating the environment in endlessly complex ways occurs by refined movements of a hand. In conclusion, with every movement that takes place, the brain is more fully activated and integrated, which naturally opens the door to learning (Hannaford, 1995).

As a baby's movement grows, each development increasingly allows the senses (ears, nose, mouth, hands and eyes) to be placed in an advantageous spot for environmental input. The vestibular system, attached to the muscles of the abdomen and the back, works to lift the head. When neck muscles develop and the baby can lift its head, the child hears with two ears and sees with two eyes. Eventually, this development expands into the act of crawling which develops the brain and bilateral movement functions. This function of bilateral movement is also a skill required for reading (Hannaford, 1995).

The eyes and eye muscles are constantly moving as a child explores the environment. The child's vision is most effective when the eyes are actively moving, taking in sensory information



from the environment. When the eyes stop, they are no longer receiving sensory information. For example when a child stares, or spaces off, he/she is no longer taking in sensory stimuli, and misses any type of learning or input from the environment (Hannaford, 1995).

### Conclusion

Movement appears to be a key component in stimulating the brain. Once the brain is stimulated, it is more prepared to receive, process, and retain information. The kinesthetic approach to learning seems to be a more effective way to prepare the body for learning compared to auditory and visual approaches. A combination of visual, auditory, and kinesthetic learning styles would enhance the learning process even more as it could reach a broader range of students.

### Direct Instruction

#### Introduction

It has been speculated that direct instruction is the most effective approach for increasing student achievement. Direct instruction promotes student on-task behavior and engagement in the academic task (Petersen, 1986).

Brophy and Good (1986) concluded that research shows students learn more efficiently when their teacher first structures new information for them and helps them relate it to what they already know. Teachers then monitor their performance and provide corrective feedback during recitation, drill, practice, or application of activities. Their description did not use the term, but

the analysis fits the style of teaching often referred to as direct instruction (Rosenshine, 1976; 1979; Good, 1979).

Direct instruction is not ideal for all learning situations. Research on aptitude treatment interaction suggest that the elements of direct instruction might be particularly effective for lower-ability students to effectively increase achievement (Snow, 1976; Cronbach & Snow, 1977; Corno & Snow, 1986). Snow (1976) speculated that the lower-ability students required more external structure and instructional support to learn compared to higher-ability students.

### A Model of Direct Instruction

Direct instruction is a systematic method for presenting material in small steps, pausing to check for student understanding, and achieving active and successful participation from all students. This method is most applicable when teaching mathematical procedures and reading decoding or explicit reading procedures (Rosenshine, 1986). This method is not as effective for teaching concepts that are not well-structured or follow specific steps. For example, reading comprehension or discussing social issues would not be relevant areas in which to use this method (Spiro & Meyers, 1984).

The direct instructional model involves direct teach, guided practice, practice, and evaluation. The direct instruction model is composed of five critical presentation skills. First of all, the teacher must elicit frequent responses from the students. Then the teacher must maintain an appropriate pace for students to learn. In order to achieve this, it is important to maintain

student attention. Next it is important to monitor student responses and adjust instruction when necessary. Finally, it is essential that all students are given an equal chance to learn (Rosenshine, 1986).

Effective teaching uses a systematic method to present material in small steps, pauses to verify student understanding and allows the student to participate actively and successfully. Seven elements have been identified as effective components of teacher-directed lessons. First of all, gaining the learner's attention is critical for influencing student achievement. The teacher must direct the student's attention to the present task. Attention may be directed with phrases like "look here", "listen", or "let's begin" followed by a pause. In order to ensure students are attending, teachers must monitor what is taking place (Rosenshine, 1986).

The second step is to review relevant past learning. When new information is linked to previous knowledge, a student can achieve an optimal level of learning. Review can occur in many forms. For example, teachers may guide students in correcting independent homework assignments or systematically review prerequisite skills needed for the day's lesson (Rosenshine, 1986).

Identifying the goal of the lesson is the third step. When the teacher refers to what is being learned, why it is important and how it relates to other learning, lower-achieving students learn best. The goal should be briefly stated and reference made as to why the skill is relevant (Rosenshine, 1986).

The fourth step is to model the skill that is to be learned. Direct teaching is applied during this step. Effective teachers demonstrate the skill prior to eliciting student responses. Classrooms utilizing instruction in small steps show higher student success rates. An added benefit is to have the students think aloud or talk themselves through the performance of the task. Modeling the task should be very clear, yet exaggerated so students pay attention to critical features. While teaching difficult concepts, ask questions to verify student understanding and increase students' attention. It may be necessary to repeat the modeling or demonstration several times (Rosenshine, 1986).

The fifth step uses guided practice to prompt for correct responses. Preventing incorrect responses and eliciting as many correct responses as possible creates an optimal learning environment. Prompted practice is repeated until students are able to demonstrate a high level of proficiency. Prompting can be done by having teacher and students do the task simultaneously. For example, the teacher may ask the student to read the work with him/her, take turns, or think out loud and then fade out their thinking aloud (Rosenshine, 1986).

Independent practice and evaluation are utilized when checking for skill mastery. Once students have demonstrated an accurate performance, they must repeat the performance under supervision without prompts. At this time, performance must be carefully monitored. Every response must be followed with feedback until the students are consistently responding correctly. Students are then provided with a number of successful repetitions which they can perform on

their own (Rosenshine, 1986).

The final step, closure, is crucial. Closure can be accomplished through review of what has been covered or a discussion of what the next lesson will cover. Providing independent work or homework assignments are also effective forms of closure (Rosenshine, 1986).

### Information-Processing Research

Theories of information-processing report limitations in the amount of information students can attend to and process effectively. If too much information is presented, there is a breakdown in the processing of the working memory, and the information is not accurately processed (Tobias, 1982). For this reason, teachers should teach small amounts and allow for practice and review to achieve a maximum working memory. New material must be processed and transferred from the working memory to long-term memory. This can be done effectively by using techniques such as reviewing, rehearsing, or summarizing through active practice. When material is initially learned, extensive practice and review must be done so it can be effortlessly recalled. After this becomes automatic, our working memory is opened or freed to allow for application and higher-level thinking (Rosenshine, 1986).

In summary, when teaching new material, it is important for teachers to provide instructional support. This support is given when small steps are used to reduce confusion, the student is given active practice at each step to move the information into long-term memory, and additional practice is given to master quick recall (Rosenshine, 1986).

### Distar - Application of Direct Instruction

The Engelmann-Becker Model is an accelerated, academically focused program involving many verbal instructions and exchanges. The program is intensive and highly structured. It was designed to assist preschool through third graders to develop reading, language and math skills. By concentrating on these skills early, students learn fundamental academic skills which may prevent failure in upper grades (Chow & Elmore, 1973).

Each subject of reading, language, and math has a complete curriculum. These materials, called Distar, are presented in simple to complex tasks using small simple steps. Students with compatible abilities work in groups of five or six. Teachers can monitor individual progress through frequent built-in tests which allow students to progress at their own rate. Students do not just listen, they are actively involved in the program. Students are frequently asked to respond during the lesson. Distar materials provide instructions on how to maintain interest and alertness as well as what to say at each step. The students are praised and rewarded by the teacher. Take-home sheets, reinforcing current goals through various exercises and pictures, are used as rewards for work well done. This also provides closure and an opportunity to get parents involved (Chow & Elmore, 1973).

### Direct Instructional Research

Even though the evidence supports the effectiveness of direct instruction, particularly in the achievement of lower-ability students, questions about this method have been raised.

Leinhardt, Bickel, and Pally (1982) argued that students must spend time reading orally and silently if they are to learn to read rather than discussing reading as the model suggests. Students must spend time discussing or writing about the concepts if they are to be tested in these areas.

Leinhardt, Bickel, and Pally (1982) conclude that "Direct instruction in criterion-relevant material is in competition with more humanistic and indirect approaches to learning. . . . direct instruction does interfere with the simultaneous use of other valued approaches" (p. 409).

Petersen (1979a; 1979b) questioned the effectiveness of direct instruction. Direct instruction has been effective for promoting achievement on standardized tests in reading and math. Primarily these tests assess lower-level skills in these areas. Direct instruction may not be the most effective method for promoting students' achievement of higher-cognitive skills in reading and math.

Direct instruction may be necessary, but insufficient for achievement in of students with higher-level skills. Higher-order thinking in reading and math may require a less direct instructional approach that transfers some of the burden of teaching and learning from the teacher to the student. As a result, this method promotes greater student autonomy and independence in the teaching-learning process (Peterson, 1986).

Peterson (1979a) found that although the effect sizes were small, they suggested that with the more direct approaches of traditional teaching, students tended to perform slightly better on achievement tests, but they did worse on tests of abstract thinking, such as creativity and problem

solving. Conversely, when less direct, more open approaches were used, students performed slightly worse on achievement tests, but tended to do better on creativity and problem solving.

Doyle (1983) argued that a certain degree of "unstructuredness" may be necessary even in direct instruction for teachers to determine whether students really understand how and when to use their knowledge and skills. In some cases it may be necessary to allow students to experience the content so they can invent procedures and construct knowledge structures on their own.

In their research, Snow and Lohman (1984) have concluded that a more structured treatment may help less intelligent students to overcome their lack of aptitude by reducing the complexity of the learning task or by direct training of component assemblies needed for task performance. They also discovered that structured treatments may either depress or nourish learning in higher ability students, or it may not affect learning at all.

Veenman and Elshout (1995) reached similar conclusions with the effectiveness of structure in lower ability students. They concluded that a structured environment enhanced learning performance in students with low intelligence and a lower level of metacognitive skillfulness, while the structured environment interfered with learning of low intelligence students with a higher level of metacognitive skillfulness. The level of learning in high intelligence students was not affected by a structured environment regardless of their level of metacognitive skillfulness (Veenman & Elshout, 1995).



## Chapter III

### Summary and Conclusion

#### Implications for Further Study

The intelligence quotient has a predictive value about a student's ability to perform in school and may determine his/her eligibility for special services. The search for understanding of intelligence began with Franz Joseph Gall's observation of correlations between mental characteristics and the shapes of people's heads, known as phrenology. Then psychology was established as a science. Statistical methods were used to rank intellectual powers which sparked the development of the intelligence test. As a result of his evaluations, Piaget advanced these measures as he believed more factors were involved in intellectual abilities. After reviewing a variety of sources, Gardner identified eight "signs" of intelligence and at least seven different intelligences, or abilities of "talent". Numerous combinations of these intelligences exist as no two people have the same configuration of intelligence. This theory changes how we view student potentials and educators' responsibility for teaching students to achieve their maximum potential. Although the theory of multiple intelligence was not intended for educational purposes, it has great potential in the classroom.

Various reasons have been noted as to why a student does not learn. It is important to understand the relationship of sensation, perception, and memory, or modalities. Modalities make use of visual, auditory, and kinesthetic approaches as to how a student learns best. The

dominant modality is the method which is most efficient for a student to learn. The student's efficiency will be more enhanced if the teacher can present the curriculum so that the student can utilize his/her individual learning strength.

Identifying an individual's learning style can be difficult as so many combinations and circumstances exist within a classroom. Many people, and years of research, have contributed to the development of methods which identify learning styles. The ITPA was one of the first formal means of learning style identification. Other observations, attempts, and approaches were made with intentions of identifying learning styles. Dunn and Dunn identified four different stimuli composed of eighteen elements which can influence individual styles of learning. Questionnaires like the LSI and SBMI were also developed to identify learning preferences and modality strengths.

The existence of individual differences in learning styles and cognitive aptitude is well-established. Development of these theories has improved the educational process. Aptitude treatment interaction, closely related to learning styles, identifies a strength or weakness of an individual, and takes this characteristic into account when selecting the appropriate teaching methodology. The overall premise is that if styles and aptitudes are properly addressed then all students can learn more effectively. Proponents of this concept insist that every classroom can accommodate the wide variety of learning styles and aptitudes.

Research involving learning styles and aptitude treatment interactions has often been

composed of small studies and reports from individual schools. As a result, large scale studies using experimental and control groups, independent and dependent variables and well-defined measurements in such areas as long-term gains remain scarce. It should be noted that most studies demonstrate significant levels of achievement once the learning style preferences have been incorporated. The results are significantly high and achieved shortly after the program is implemented. Regardless of the model and instruments involved, teachers, students, and parents appear pleased with the outcome.

One match of aptitude or learning style involves the kinesthetic component. Kinesthetic learners have unique characteristics. They tend to fall behind scholastically as most teachers teach using the auditory and visual channels. Most younger children appear to be kinesthetic or tactual learners, but learn to adapt or combine their abilities to be able to function more effectively in the classroom. This can be extremely difficult for some students.

Active learning may motivate students to learn as activities are exciting, fun, and challenging. Students become engaged in their environment. They move around out of their seat, and are allowed to think out loud. Being actively involved can also mean discussing and asking questions about the learned material. Active learning is more effective when the three goals have been accomplished. By using as many components of the body as possible, the brain can function more effectively. Motivation, retention, and understanding are likely to improve in an active environment.

The direct instruction model is another alternative to accommodate a variety of learning styles, or aptitude. This model is composed of five critical presentation skills and seven simple steps to make learning more effective. The Distar curriculum is a specific example of the application of the direct instructional model. Distar uses simple steps to get students involved while it focuses on reading, language, and math skills. Direct instruction is an effective approach, particularly for lower-ability students, for increasing student achievement. This model of instruction appears to be most effective for students with lower levels of intelligence.

In education, there are many components to be considered throughout the learning process. It is important to keep in mind that each student maintain their status as an individual learner. When this takes place, the student will be able to use his/her strengths to become a more effective learner.

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