AN ABSTRACT OF THE THESIS OF

Kathleen M. Zachow for the degree of Doctor of Philosophy

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Title: An Investigation of the Relationships Among Perceptual Modality, Temporality, and Academic Achievement of Selected Middle School Sixth, Seventh, and Eighth Grade Students

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Mary Jane Wall

The primary foci of the study were to determine the relationships among perceptual modality, temporality, and academic achievement, and to develop implications for the academic counseling of middle school students based on the findings.

The sample was composed of 613 students enrolled in Prineville Junior High School. The Edmonds Learning Style Identification Exercise, the metronome, and the Iowa Tests of Basic Skills were the instruments used to collect data.

Five statistical tools were used in the analysis of data. The findings at the .05 level of significance were as follows:

1. There were no significant differences in perceptual modality mean scores for the three temporal groups.

2. There were no significant relationships between sex and temporal grouping (slow, medium, fast).
3. A significant relationship existed between grade level and temporal group. There was a higher concentration of sixth graders in the slow temporal group.
4. There was a significant difference between sex and the perceptual modality score of visualization. Males scored significantly higher. For the other three perceptual modality scores and sex, there was no significant differences.
5. There was no significant difference for grade level and perceptual modality mean scores.
6. There was no interaction for grade level and sex on perceptual modality mean scores.
7. There were no significant relationships among perceptual modality scores within each temporal group.
8. There were no significant relationships among academic achievement scores, preferred temporal pace, and perceptual modality scores.

Implications for the academic counseling of middle school students stressed the importance of using visual materials in the curriculum for males, and the varying of instructional pace to accommodate differences in students' temporal paces.

An Investigation of the Relationships Among Perceptual Modality, Temporality, and Academic Achievement of Selected Middle School Sixth, Seventh, and Eighth Grade Students

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We travel not alone
although we often feel
or need to think so . . .
In our earthly tenure
many mellow spirits
step into our space . . .
Enriching our minds
touching our vulnerability
stroking our souls . . .
no . . . my flight is
not solo, for I
carry with me the
interwoven tapestries
of those who reached
in time . . .

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CHAPTER I

INTRODUCTION

The junior high school years signal the entrance of the individual into the period called adolescence. It is during adolescence that an individual's physical, emotional, and social changes are most noticeable. These changes can both please and frustrate parents, teachers, administrators, and counselors. Who has not heard a parent or teacher say, "junior high school students appear indifferent to learning, yet very intent on socializing with their friends"?

Recent brain study has enlightened us as to a possible cause of this disinterest in new learning. Epstein and Toepher (McDaniel, 1982) have postulated that brain growth occurs in spurts, followed by slower growth periods and plateaus. One of the theorized plateaus occurs during the middle school or junior high school years:

> This plateau period is characterized by a closing down of cognitive growth. The brain itself grows very little, making it much more difficult for seventh and eighth graders to initiate new or higher-level thinking skills (McDaniel, 1982, p. 467).

Instead of new challenges, this period would best be utilized by practicing already acquired skills.

Hemisphericity also plays a role in brain development. Staley (1980) feels that schools emphasize the cognitive aspects of reasoning, logic, and objectivity which are all left brain activities while ignoring the right brain activities of visualization, feeling, and imagination. Soares and Soares (1982, p. 9-10) state the case for recognition of brain periodization and hemisphere functions:

> The combination of spurts in brain growth and hemispheric activity suggests that left-brain functions may very well be stimulated by a brain which is experiencing rapid growth. Right-brain functions may be enhanced during calmer periods of plateaus in brain development. It might mean that the 12-14 year old students, who are experiencing slower brain activity, might very well profit from a couple of days each week outside the school environment. They could be involved in community work rather than the typically, and often intensely, academic environment of the junior high every school day of every school week.

Yet, the reality for junior high school students is that they are expected to acquire new skills and, in some cases, achieve more than in previous school years. Students experience pressure from teachers and parents to perform and perform well. Contrary to what teachers and parents might think regarding apparent student indifference, approximately fifty percent of this counselor's sessions involves students who are concerned with their school work.

An informal study was conducted at Prineville Junior High School this fall. In a random selection of report cards from the

years 1975-78, 88 report cards were selected. The selection was based on the card showing one-third or more "D" or "F" grades. The progress of these students was followed through high school. The results were that of the 88 students selected, 61 (which represents 79 percent) did not graduate. This crude assessment of student achievement demonstrated that the educational system was not being highly successful in reversing failure patterns identified at the junior high school level. Yet, schools often continue to attempt to educate students through teaching strategies that confine students to a failure pattern.

An example of a teaching strategy that may confine students to failure patterns is the persistent use of verbal instruction in the classroom. Dunn and Dunn (1978) have demonstrated that only 20 to 40 percent of the student population learn best through auditory instruction. This leaves 60 to 80 percent of the students perceptually handicapped because instruction is not in their strongest sensory modality.

A review of the literature concerning learning styles revealed that learning styles are individualistic, can be assessed using learning style instruments, and when teaching strategies are matched with student learning styles, increased motivation, a more positive attitude, and higher academic achievement occurred. These teaching strategies need to be multimedia and multisensory to accommodate differing perceptual strengths and weaknesses of the learner.

With the increased interest in learning style analysis, the role of the counselor will change. A counselor will need to become more conversant with individual differences in learning style and be able to consult with teachers regarding these differences (Gregg, 1982).

To date, the concept of time in learning style analysis deals with the time of day that is most advantageous for an individual to learn. Yet, clock time is only one dimension of time that is important in learning. The manner in which an individual relates to time or his/her temporal consciousness is reflected in the individual's preferred temporal pace (Barsch, 1974). No present learning style instrument deals with preferred temporal pace as a dimension of learning style. The relationships among temporal pace, perceptual modality, and academic achievement appear to be unexplored.

Statement of the Problem

The primary foci of the study were: 1) to contrast perceptual modality scores and preferred temporal pace, 2) to determine the relationships among perceptual modality, temporal pace, and academic achievement. The sample was composed of selected sixth, seventh, and eighth grade students enrolled in Prineville Junior High School. Perceptual modalities were ascertained by the Edmonds

Learning Style Identification Exercise (ELSIE) and the scores (visualization, written word, listening, and activity) utilized as four of the dependent variables; temporal pace, sex, and grade level served as the independent variables.

The Objectives

The two objectives encompassed by the study were:

1. To identify the perceptual modality, temporal pace, and academic achievement patterns emerging from each of the considerations being studied, and to statistically analyze data associate with contrasts and comparisons among the sample groups.
2. To develop implications for academic counseling of middle school students based on the findings of this study.

The Dependent Variables

The dependent variables for the study were: 1) the respondent's visualization, written word, listening, and activity scores as measured by the Edmonds Learning Style Identification Exercise; 2) the respondent's composite scores (expressed as percentiles) in language, reading comprehension visual materials, and math as mea-

sured by the Iowa Tests of Basic Skills. Both sets of scores were assumed to be of the equidistant interval type.

Null Hypotheses

The students were grouped according to the independent variables (temporal pace, sex, or grade level). The research was organized to: 1) contrast perceptual modality scores, preferred temporal pace, and demographic characteristics of sex and grade level, and 2) to determine the relationships among perceptual modality, temporal pace, and academic achievement.

A minimum significance level of .05 was used as the criterion for statistical significance for each of the following null hypotheses:

HO_1: There are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) for the three temporal groups (slow, medium, fast).

HO_2: There are no significant relationlships among demographic characteristics (sex, grade level) and temporal group (slow, medium, fast).

HO_3: There are no significant differences in perceptual modality mean scores (visualization, written word, listening,

and activity) by demographic characteristics (sex, grade level).

HO_4: There are no significant relationships among perceptual modality scores (visualization, written word, listening, and activity) within each temporal group (slow, medium, fast).

HO_5: There are no significant relationships among academic achievement scores (language, reading comprehension, visual materials, and math), preferred temporal pace, and perceptual modality scores (visualization, written word, listening, and activity).

Definition of Terms

The following definitions are pertinent to this study. Other terms or phrases in the text were deemed to be self-evident or explained in context.

Academic Achievement: Current (1983) composite scores expressed as percentiles on the Iowa Tests of Basic Skills in the following four areas:

1. Language: Spelling, capitalization, punctuation, and usage.
2. Reading Comprehension: Reading a paragraph and answering

questions regarding it.

3. Visual Materials: The interpretation of maps, charts, and graphs.

4. Math: Concepts, problem solving, and computation.

Academic Counseling: Assistance rendered to a student regarding his/her progress in school studies.

Edmonds Learning Style Identification Exercise (ELSIE): Measures four perceptual modality areas and gives a profile of the scores. The four areas are (Reinert, 1976, pp. 165-166):

1. Visualization: This category indicates the relative importance of the learner of actually seeing objects and activities in order to learn.

2. Written Word: This category is distinguished from the first by noting whether a person will get more detail from a certain incident by seeing the event occur (visualization) or by reading a description of the event (written word). Persons scoring very high in this category have a great dependence on the written word, and for such students the prereading unit of traditional audiolingualism was highly frustrating. Persons scoring very low in this category may read quite well, but they tend to translate written words into another category (visual images or sounds) rather than being able to get meaning from the words immediately.

3. Listening: This category indicates the degree to which the person is able to learn from hearing the spoken language without recourse to some other mode. Persons scoring very high in this category will find tapes an invaluable aid in learning a foreign language. Those scoring very low will probably need to do remedial work in learning to understand the

spoken language.

4. Activity: This category represents the relative importance of some manner of physical activity to the learning process. A person scoring above the median band in this category will find it a definite advantage to become physically active in some way in order to facilitate learning. Such activities can be as simple as taking notes or writing out exercises, and one participant--while denying that this interpretation applied to her--said that when she needed to memorize something, she always paced the floor. Persons scoring fairly high in this category are usually compulsive note takers in class or at lectures (and even films), but they will seldom need to refer to their notes at a later time, for the activity of writing seems to impress the information on their memory.

Learning: The process through which an individual develops or acquires knowledge, skills, or attitudes. It is influenced by the interaction of many individual and environmental variables, is highly related to language development, and its development or acquisition may be originated or modified through planned educational intervention (Gearheart, 1981, p. 46).

Learning Style: An individual's learning style is the way that person is programmed to learn most effectively, i.e., to receive, understand, remember, and be able to use new information (Reinert, 1976, p. 161).

Perceptual Modality: Interacting with the environment through one or more of the basic senses (Sperry, 1973, Keefee, 1982). The three basic sensory modes are: visual (reading and seeing), auditory (hearing and speaking), and kinesthetic (feeling, touching, or doing).

Preferred Perceptual Modality: The tendency for an individual to use one perceptual (sensory) modality over another.

Preferred Temporal Pace: An individual's way of relating to time which is most comfortable to him/him as an action pattern. This pace is expressed in beats per minutes as measured by the metronome.

Temporality: The individualized time character of the student based on his/her temporal consciousness. Barsch (1974, p. 3) defines temporal consciousness as:

> a composite state of mind. At any given moment a person's state of temporal consciousness is a reflection of his aggregate of time experiencing, acquired attitudes towards chronic demands, his distinctive personal pattern of circadian rhythm, the integrity, vitality and harmony of all interrelated biologic and physiologic rhythms, the quality and rate of his mental processing, his coping strategies in the face of temporal stress and many other time-oriented traits.

Temporal Pace: Designation of time preference in the individual, the individual's style of relating to time.

Temporal Pacing Exercise: The use of a metronome to determine an individual's temporal pace. Based on metronomic rates, slow temporal paces are between 40-70 beats per minutes (b/m), medium temporal paces are between 72-120 b/m, and fast temporal paces are between 126-208 b/m.

Limitations of the Study

The study included the following limitations:

1) The subjects in the study were all middle school students (grades six, seven, and eight) which limits the findings to those particular grade levels.
2) The study was conducted in a small rural town (Prineville, Oregon, population 5,246) with a middle school population of 628. This limits the findings to similar size middle school populations in rural towns.
3) Minority representation (Hispanic, Asian, Native American, Black) at Prineville Junior High School was less than one-half of one percent.
4) Both the ELSIE and Temporal Pacing Exercises are self-reporting instruments. As with all self-reporting instruments, there is a chance of individual response distortions.

Basic Assumptions of the Study

The study included the following basic assumptions:

1) That each student has a preferred temporal pace.
2) That each student's perceptual modality scores will show

preferences within the individual profile.

3) Time of day, during which the exercises and the Iowa Tests of Basic Skills were administered, is not a factor in this study.

CHAPTER II

LITERATURE REVIEW

The back to basics movement, PL 94-142, minimum competency testing, gifted education, accounts of violence and vandalism in the public schools, and the tightening economic conditions of some local school districts, represent public concern for educational accountability. Pressure is being applied to legislatures and courts, both local and national, to enforce such accountability. In response to this ever increasing pressure, educators are seeking and testing new diagnostic tools. Bloom (1977) stipulated that past research on instruction tended to focus on ways in which the teacher managed the learner, rather than the ways by which the teacher managed learning.

Learning, for the purpose of this study, shall be defined as:

> The process through which an individual develops or acquires knowledge, skills, or attitudes. It is influenced by the interaction of many individual and environmental variables, is highly related to language development, and its development or acquisition may be originated or modified through planned educational intervention (Gearheart, 1981, p. 46).

To determine these individual and environmental variables and to plan appropriate educational interventions, the concept of learning styles is of growing importance to the professional educator.

Learning style analysis offers educators one avenue to answer the public concern for educational responsibility.

It shall be the purpose of this chapter to present an overview of the concept of learning styles, to associate learning styles with academic achievement, to detail perceptual modality as a primary ingredient in learning style, and to offer the concept of temporality as an important, but as yet little researched, dimension of learning style.

Learning Style

In the traditional classroom, regardless of individual differences, all students are exposed to the same curriculum through the same instructional approaches (mainly auditory) at exactly the same time to exactly the same depth (Dunn and Dunn, 1975). Yet, in the 1960's research was indicating the existence of learning styles. These studies demonstrated what educators had known for a long time, that each person, regardless of age, intelligence, or socioeconomic status, learns differently (Talmadge and Shearer, 1969). During the 1970's there was a growing body of research that sought to identify individual learning styles. From that research has come a long list of learning style instruments which emphasize varying aspects of learning styles. Selected examples of learning style instruments are: 1) General Assessment: Cognitive Style Mapping Inventory by

Joseph E. Hill (1964), Learning Style Inventory by Rita Dunn, Kenneth Dunn, and Gary E. Price (1978). 2) Cognitive Assessment: Group Embedded Figure Test by Philip K. Oltman, Evelyn Raskin, and Herman A. Witkin (1971). 3) Affective Assessment: Internal-External Scale by Julian B. Rutter (1966). 4) Perceptual Assessment: Edmonds Learning Style Identification Exercise by Harry Reinert (1975), and Swassing-Barbe Modality Index by Walter Barbe and Raymond Swassing (1981).

These assessment instruments analyze different aspects of the learner, therefore, the definitions of learning styles vary. These definitions range from: inborn, natural predispositions or proclivities (Gregorce, 1979, Schmeck, 1982), cognitive, affective, and physiological traits (Keefe, 1982), to the manner in which at least eighteen different elements from four basic stimuli (environmental, emotional, social and physical) affect an individual's ability to absorb and retain information (Dunn and Dunn, 1978). An individual learning style may reflect: 1) genetic coding, personality development, and environmental adaptation (Gregorce, 1979), 2) influencing factors such as background, parents and sex (Douglass, 1979), or 3) cultural heritage, Button, 1977; Harvey and Horton, 1977; Kuntz and Letteri, 1981).

Many researchers use the term learning style and cognitive style interchangeably. Dunn (1981 p. 34) believes the terms are complementary yet different. Learning style "is the way in which

individuals respond to external stimuli . . . , cognitive style describes the ways in which the brain processes information." Therefore, learning styles describe an individual in terms of those educational conditions under which he/she is most likely to learn (Hunt, 1979, Levy, 1982).

For the purpose of this study, the definition of learning style reflects an integration of the individual's response to external stimuli and the internal processing of information.

> An individual's learning style is the way that person is programmed to learn most effectively, i.e., to receive, understand, remember, and be able to use new information (Reinert, 1976, p. 161).

Programming refers to aptitude or talent and is neurologically based. "It is the result of certain synapses operating more quickly or certain nerve pathways being more readily available in some persons than in others" (Reinert, 1976, p. 160). According to this definition, the individual's learning style is best assessed by the Edmonds Learning Style Identification Exercise (ELSIE), and learning activities are selected based on the learner's profile. The implications of this particular definition of learning style will be discussed later in connection with perceptual modality.

Learning style research has confirmed that each individual learns differently. It is virtually impossible for a teacher to assess the learning style of each student by observation alone (Marcus, 1977). Before teaching strategies are selected, formal

learning style assessment must be done; the result must be discussed with the individual; the type of learning task employed must be considered; and the learning activities selected must be based on assessment and conversations with the individual (Harvey and Horton, 1977; Marcus, 1977; Dunn, Dunn, and Price, 1979; Gregorc, 1979; Ribich and Schmeck, 1979).

Also important, in the assessing of individual learning styles, is the recognition that learning styles are malleable (Davidman, 1981), and that they can be maximized and strengthened by proper educational intervention (Reinhert, 1976; Dunn and Dunn, 1977; Davidman, 1981). Furthermore, learning styles change across grade levels, yet remain consistent within a given grade level regardless of the subject being studied (Copenhaver, 1979; Hunt, 1981; Schmeck, 1982). It is not certain whether the change in learning style of the individual is a function of development or maturation, but it appears to parallel the growth curve (Hunt, 1981; Schmeck, 1982).

Learning style analysis is done with an individual, not to an individual. Stressing the word individual is important. Limited initial research has revealed few similarities among the learning styles of siblings, children and parents (Dunn, 1981). Domino (1970), Farr (1971), and Dunn and Dunn (1977) demonstrated that students can accurately describe their own learning style preferences. Andrews (1981, p. 177) in his study of freshman at the University of California found that "students will choose, consciously

or unconsciously, to use resources available in a course that are most compatible with their learning style." When the student is a consultant in his/her learning style analysis, he/she can become more responsible for his/her own learning (Gregorc, 1977 and 1979; Ballinger and Ballinger, 1982; Kusler, 1982). However, Gregorc (1977) cautions that because a student expresses preference in a particular learning mode (style), that student may not necessarily be competent in that mode. In other words, preferences are not always strengths. It is here that teacher supervision is important.

Learning is affected by the interaction between the students and teacher. This interactive process is influenced by the students' learning styles and the teacher's style. Until recently, teacher's style was often neglected in learning style research (Butler, 1982). A teaching style consists of "the teacher's personal behaviors, and the media used to transmit data to or receive it from the learner" (Gregorc, 1979, p. 22). McDaniel (1982) believes that teachers teach in the same perceptual modalities by which they learn. Teachers project their own modality strengths into selection of materials, teaching strategies, and classroom procedures (Barbe, Swassing, Milone, 1979; Cornbleth, 1981). As early as 1974, Dunn and Dunn urged educators to assign students to teachers where teaching styles complimented the students' learning styles. Hankins (1974) also found in his study of college students that the quality of learning was dependent upon the teaching style

being matched to student learning style. Gregorc and Ward (1977, p. 24) state it most succinctly: "We believe that the most successful students in a given classroom happen to possess learning preferences that match the instructional method preferences of the teacher." Copenhaver (1979), in his study of 76 high school students, found more positive attitudes toward a subject when student learning styles were congruent with their teachers' teaching style.

Yet, not all research advocates matching students and teachers. Raywid (1977) suggests that students accomplish more with teachers who vary their styles rather than utilizing one particular style. One method or style should not be used exclusively as teachers are flexible enough to respond to differences in student learning styles (Dunn and Dunn, 1979). What is needed is a wide range of alternative teaching strategies that complement various learning styles. Complementing learning style with appropriate teaching strategies will result in students scoring higher on tests and factual knowledge, having more positive attitudes, and being more motivated (Domino, 1970; Copenhaver, 1979; Shea, 1983; Tannenbaum, 1983). Academic achievement will be discussed in greater detail in the following section.

The consequences of not varying teaching strategies to complement different learning styles of students may be: bored and restless students (Begley, Carey, and Sawhill, 1983), lower academic achievement (Bruno, 1982), poorer self-concept on the part of the

student (Dunn, Dunn, and Price, 1979; Griggs and Price, 1981), the fostering of discipline problems (Marcus, 1977, Lynch, 1981), and possible misdiagnosis of students as learning disabled (Gregorc, 1982). To the latter point, Gregorc, (1982, p. 7) asks "are the learning disabled all truly disabled in a neurological sense, or is their disability, in some cases, symptomatic of their inability to align and adapt to style expectations of the classroom?"

While it is advantageous to match teaching strategies to student learning styles, brief and occasional mismatch is beneficial. Blakeslee (1982) and Butler (1982) both advocate that guided and controlled mismatch will result in flexibility, tolerance for individual differences, and the discovery of hidden talents. Nevertheless, the major focus of learning style analysis remains to identify those educational conditions under which the learner can maximize his/her academic achievement.

Academic Achievement

Stronck (1980) stipulates that the traditional system of classroom instruction and grading guarantees a stabilization of students at their typical achievement level. Longitudinal research shows increasing stability of school marks and test performance through the school years. Stronck (1980) believes this stabilization reflects a learner's attitude and motivation toward learning. If

students achieve success in initial tasks in earlier grades, they are more likely to approach later tasks with more enthusiasm, confidence from having succeeded, and possess the cognitive abilities to handle increasing learning complexities. In fact, Bloom (1977 p. 190) estimates that "cognitive entry behavior may account for half the variance on achievement measures of subsequent learning tasks." If this is the case, Bloom (1977) believes that students are graded or evaluated not on what they learn in a given course, but on the relevant cognitive entry skills they possess prior to the beginning of the subject area in question.

Dunn, Dunn, and Price (1977) believe that how a student learns, as measured by learning style analysis, is the most important factor related to academic achievement. A number of research studies found that matching teaching strategies to students' learning styles resulted in improved academic achievement. Nine selected studies that documented this are: Domino, 1970, 100 college students; Martin, 1977, 218 high school students; Trautman, 1979, junior high students; Carlo, 1980, kindergarten children; Cavanaugh, 1981, high school students; Pizzo, 1981, 64 elementary school students; Tannenbaum, 1982, 100 high school students; and Shea, 1983, 32 ninth grade students. These studies, which include all grade levels, demonstrate the consistency of improved academic achievement by matching learning styles and teaching strategies.

In an extensive study by Cafferty (1980) academic achievement

(as defined by grade point) was higher for those students who had their learning styles matched with appropriate teaching strategies. Letteri (1982, p. 69) found that a

> battery of seven cognitive tests formed a profile that differentiated seventh and eighth grade students by achievement level; and that this profile could accurately predict academic achievement across all subject areas.

The subject area that has received the most extensive evaluation of academic achievement and learning style is reading. When various aspects of the individual's learning style were matched with appropriate teaching strategies, higher reading scores resulted (Carbo, 1980; Pizzo, 1981; Hodges, 1982; Krimsky, 1982; and Shea, 1983). Of the studies cited, Carbo was the only one utilizing the perceptual modality component of learning style with reading achievement.

Perceptual Modality

There are three basic sensory modes by which people in our American culture interact with their environment: visual (reading and seeing), auditory (hearing and speaking), and kinesthetic (feeling, touching or doing). The concept of interacting with the environment through one or more of the basic senses is called perceptual modality (Sperry, 1973; Keefe, 1982). Preferred perceptual modality is the tendency to use one sensory modality over

another. People differ in their preferences. As early as 1894, researchers sought to establish the superiority of one perceptual modality over the others. Through the years, conflicting results have been found. The thrust in learning style analysis is to teach the individual in his/her preferred perceptual modality as much as possible.

Developmentally, most children progress from a perceptual modality preference for kinesthetic during the preschool years to visual, and then auditory (Sperry, 1973). A dominant preference usually forms early in life, and does not change radically (Keefe, 1982). In adults, the perceptual modalities usually work in parallel. Information gained in one modality supplements knowledge gained in another. Sperry (1973) states that the perceptual modalities in children do not function cooperatively, as in the adult; integration of the three perceptual modalities occurs sometime in middle adolescence.

Perceptual modality as an element of learning style was explored by Marcus (1979). Marcus' study concerned student placement in three social studies classes based on a battery of tests. The three levels were: above-average, average, and below-average as measured by teacher observations, past achievement, I.Q. scores, and reading comprehension tests. Perceptual modality, using the Learning Style Inventory, was assessed. The results revealed that students in the above-average group were either auditory or visual and

had more than one perceptual preference. Those in the below-average group tended to be kinesthetic learners or had no perceptual preference.

Sex appears to be a factor in perceptual modality preference. Price (1977) found that the higher the grade level in school, less males preferred to learn kinesthetically. Females in grade seven and above tended to prefer the auditory modality. Barbe and Milone (1982) found that females, from childhood to adulthood, were just as kinesthetic as males. However, few females knew they were kinesthetic learners.

Kinesthetic learners are often labeled as slow or poor achievers. Barbe and Milone's study (1982) indicated that kinesthetic learners had academic achievement scores equal to other perceptual modality groups. Reading, according to the same study, was the only academic area where a combination of preferred kinesthetic and auditory modalities resulted in lower scores.

Experts claim that reading ability requires an integration of visual and auditory modalities (Barbe and Milone, 1982; Carbo, 1982). Students with visual preferences and no auditory skills experience the same reading difficulties as kinesthetic-auditory learners. This auditory-visual integration occurs earlier for females, grades 1-3, than for males, grades 2-4 (Reilly, 1971).

Dunn, Dunn, and Price (1979) found that kinesthetic learners appear to require frequent mobility. Such learners find it diffi-

cult to just sit and listen. Not surprisingly, these learners frequently become discipline problems because, in the traditional classroom, the most common strategy is the lecture method. Dunn and Dunn (1977, p. 123) report that "two to four children in ten learn best by listening, and three to four in ten learn best visually." This is significant when 90 percent of the instruction in the traditional classroom is verbal. So-called slow learners are frequently kinesthetic learners, yet visual aids have been emphasized for use in resource rooms as well as the regular classroom (Bernstein, 1974).

The accuracy of teacher observation in predicting preferred perceptual modality of students is poor. In a study by Marcus (1977) teachers perceived correctly those students who were auditory learners. In the other perceptual modalities, there was a very high percentage of inaccuracy. In explaining the discrepancy between teacher observation and student self-report, Marcus (1977, p. 114) states

> perhaps the reason for such disagreement in the areas of perceptual modality can be attributed to the fact that the children are not working in their best learning style because of the teachers' misperception concerning the student's perceptual preferences.

Madison Prep (New York City) developed an alternative junior high school designed completely around diagnosing and addressing individual learning styles. Of all the learning style elements, perceptual strengths and structure appeared to have the most import-

ance in determining teaching strategies (Hodges, 1982). Bishop Carrell High School, another alternative program in Calgary, Alberta, changed the curriculum and instructional methods to include multi-sensory approaches based on learning style analysis (Vigna and Martin, 1982).

Dunn and Dunn (1975, 1977) are the strongest proponents of teaching strategies that utilize multimedia, multisensory resources. They advocate that materials should be introduced through the strongest perceptual modality and reinforced through the minor perceptual modalities. By using a multisensory teaching approach, teachers can help students overcome perceptual difficulties experienced in the traditional classroom.

Barbe and Milone (1981, p. 378) state that in terms of achievement, "students with mixed modality strengths have a better chance of success than do those with a single modality strength because they can process information in whatever way it is presented."

Student motivation affects perceptual weaknesses. Dunn and Dunn (1979) believe that student motivation can overcome some perceptual weaknesses, but constant attempts to use inappropriate perceptual modalities will lessen motivation and affect achievement. Yet, because an individual's environment is multivariant, not only must perceptual preferences be accommodated, but perceptual weaknesses strengthened. Both the Edmonds Learning Style Identification Exercise (Reinert, 1975), and Swassing-Barbe Modality Index (Barbe

and Swassing, 1979) give perceptual modality profiles which illustrate strengths as well as weaknesses.

A relatively new counseling approach that stresses the importance of an individual's perceptual preference is Neuro Linguistic Programming. Bandler and Grinder (1975), label perceptual modes as input channels: visual, auditory, and kinesthetic. They believe each individual has a preferred mode of receiving information, and that an individual describes his/her experiences through language which indicates which is the favored input channel. This language description, reflecting preferred input channels, is called the most valued representational system of the individual (Grinder and Bandler, 1976). Harman and O'Neill (1981, p. 450) link input channels and memory:

> The Neuro Linguistic Programming belief is that we store our experiences in the most favored representational system. If we are primarily auditory, that is, taking in through hearing, then it follows that we store information (memory) in the same system. If we are visual . . . .

If language is an indicator of the individual's most favored input channel, then understanding the concept of perceptual modality as a component of learning style takes on added importance.

Temporality

The concept of time, as an element of an individual's learning style, is important. Dunn and Dunn (1978) have developed a time

questionnaire that determines at what time of day the individual prefers to work. Some individuals learn best in the morning, others in the afternoon, and others in the evening. These personal variations in learning readiness are called time rhythms (Keefe, 1982).

In a correlational analysis of the elements of the Learning Style Inventory, Dunn and Dunn (1978, p. 392-394) found the following significant relationships for time rhythms:

Males and Females

1. Learning in the afternoon is positively correlated with self-motivated learners, being responsible, persistence, and for boys being teacher-motivated.

2. Learning in the afternoon is negatively correlated with unmotivated learners, the need for mobility, and the desire for food intake.

3. Learning in the morning (late morning) is positively correlated with visual, tactile, and kinesthetic preferences, learning with peers, and for boys, learning alone.

4. Learning in the morning is negatively correlated with persistence, and for girls with auditory preferences.

5. Learning in the evening is positively correlated with tactile and kinesthetic preferences, and negatively correlated with visual preferences.

This analysis demonstrates that students vary in their time rhythms, that is, their learning readiness. It appears that these time rhythms are relatively stable characteristics of an individual's learning style (Dunn and Dunn, 1978).

Lynch (1981) conducted a study matching instruction with student time rhythms. He found that matching student time rhythm preferences was instrumental in reversing truancy patterns of chronic offenders.

Barsch (1968) explored time from a different perspective, the individualized time character of the learner. Barsch (1974) labeled the individual's distinctive, characteristic, relatively consistent style of relating to time as personal tempo or temporal pace. An individual's temporal pace reflects his/her temporal consciousness. Barsch (1974, p. 3) defines temporal consciousness as:

> A composite state of mind. At any given moment a person's state of temporal consciousness is a reflection of his aggregate of time experiences, acquired attitudes toward chronic demands, his distinctive personal pattern of circadion rhythms, the integrity, vitality and harmony of all interrelated biologic and physiologic rhythms, the quality and rate of his mental processing, his coping strategies in the face of temporal stress, and many other time-oriented traits.

This individual time character of the learner based on his/her temporal consciousness is called temporality.

Barsch (1974) believes that temporality is not an elective state of mind, cannot consciously be chosen or rejected, and occurs as a matter of environmental assimilation. He believes individuals seek temporal balance (Barsch, 1974, p. 5):

> When children encounter demands, stimulations, and movements which are perceived to be <u>too slow</u> they lose sequence, continuity, and content. Their immediate world seems to be creeping . . . . At the opposite extreme, if a child perceives his immediate world to be

> moving too fast, he also loses sequence, continuity, and content. He struggles amid blurring . . . . Under such stress, children often become rebellious, impatient, impulsive, and contemptuous to signal their discomfort.

Barsch (1974) proposes that when environmental stimulation approaches the individual's temporal pace, the stage for optimal learning has been set. Receptiveness is at peak level, perception is most acute, attention is centered, and movement is most efficient.

One aspect of environmental stimulation in the classroom is the teacher's preferred temporal pace. As with the teacher's own learning and teaching styles, the teacher's temporal pace becomes a critical component in determining the classroom pace (Barsch, 1974). Teachers pace instruction. They make judgments concerning the amount of time to be devoted to an activity. Teachers may wait for the slow ones or press the class to move faster. If the teacher has a fast temporal pace, and operates at that pace, the slower paced students will be frustrated. If the teacher has a slow pace, and delivery of instruction is in that mode, the faster-paced children may become impatient (Barsch, 1974).

Cott (1968) pioneered the use of the metronome in restoring temporal balance in schizophrenics. Barsch (1974) built on these principles when he devised a pacing program to help students adjust to differing temporal paces experienced in the classroom. He devised a procedure to identify the temporal pace of an

individual. Barsch found that when individual's were exposed to the full sweep of metronomic rates (40-208 b/m), they could identify a metronomic rate most comfortable to them as an action pattern. Barsch makes no claim for the accuracy of this crude method in determining the temporal pace of an individual. To date, no other method to determine temporal pace has been devised.

As with perceptual modality, the individual's environment is multivariant. While it is important to pace instruction to match varying temporal paces, it is equally important to provide a degree of mismatch. Slower-paced students need to learn to quicken their pace; faster-paced students need to adjust their pace to slower rhythms.

Thus, the teacher needs to be aware of the concept of temporality, to assess the temporal paces of his/her students, to vary the pace of instruction to accommodate these temporal differences, and to broaden the individual's temporal range.

Summary

Public pressure for educational responsibility has increased in recent years. Educators are realizing that the schools can ill-afford to educate all students in the same manner. All students learn differently. Learning styles cannot be determined by observation alone. They must be assessed using the appropriate learning style instrument. From this formal assessment, teaching strategies

should be designed and implemented that capitalize on and strengthen individual learning styles.

The teacher also needs to understand that his/her own learning style affects his/her teaching style. The teaching style must be flexible in order to accommodate the range of student learning styles.

Research indicates that, of all the learning style elements, perceptual modality appears to have the greatest importance in determining strategies. Using learning style analysis, there is no justification for reliance on the lecture method as the predominant mode of instruction. Instruction must be multisensory to help students overcome perceptual difficulties.

Temporality is another important dimension in learning style. Every individual has a preferred temporal pace, that is, a way of relating to time which is most comfortable to him/her as an action pattern. The teacher's preferred temporal pace affects the delivery of instruction. Teachers need to know how to assess the temporal paces of their students, and to vary the pace of instruction to accommodate these temporal differences.

Improved academic achievement is the result of matching students' learning styles, perceptual modality in particular, with appropriate teaching strategies. Temporality, as a dimension in learning style analysis, has not been determined. Research is needed to explore what, if any, relationships exist among perceptual modality, preferred temporal pace, and academic achievement.

CHAPTER III

METHODOLOGY

The methods and procedures in this section include a description of the locale, subjects, instruments, method of testing, and statistical tools for analysis of data.

Locale

The subjects who participated in this research project were male and female students in grades six, seven, and eight at Prineville Junior High School, Prineville, Oregon.

Prineville is the county seat of Crook County. It has a city population of 5,246 and a county population of 13,100. Prineville is located in the geographical center of the state. The main industry centers around lumbering with four lumber mills and two moulding plants. Other industries include a tire distribution center, livestock, and farming crops of alfalfa, potatoes, and mint. Politically the county is conservative and has the distinction of being one of the two bellweather counties in the country in presidential elections.

The Crook County School District serves 2,473 students in seven schools: Crook County High School (grades 9-12), Prineville Junior High School (grades 6-8), two city elementary schools (grades 1-5),

and three rural schools. The district has an administrative staff of 15, 143 teachers, and 122 classified personnel.

The study was conducted in the Spring, 1983, at Prineville Junior High School. The school has a student population of 628 with a principal, vice-principal, two counselors, 32 teachers, and 16 classified personnel.

Subject Selection

The grade population utilized in this study was as follows: 207 sixth graders (114 boys, 93 girls), 200 seventh graders (100 boys, 100 girls), 206 eighth graders (110 boys, 96 girls). The total number of subjects was 613 (324 boys, 289 girls).

Student who met the following requirements were tested:

1. Had no parental objection to participation in the study. (See parent notification, Appendix A.)
2. Had no previous record of any type of auditory disorder. Those individuals with auditory disorders were excluded due to possible difficulty in hearing the words and the metronomic rates.
3. Had no previous health record of seizures or

epilepsy. The faster metronomic rates (120 b/m plus) may induce seizures (Barsch, 1974).

Students were given the ELSIE and temporal pacing exercises in the classroom. Raw scores from each of the four perceptual modalities measured by the ELSIE were used. Three temporal groups were formed based on preferred temporal rate: 1) slow temporal pace (40-70 b/m), 2) medium temporal pace(72-120 b/m), and 3) fast temporal pace (126-208 b/m). The temporal group rates were adapted from Barsch (1974, p. 53).

Academic achievement in four areas was assessed for each student using the following procedure:

1. Academic achievement was defined as current (1983) composite scores (expressed as percentiles) on the Iowa Tests of Basic Skills in four areas. The test was given to all students in February, 1983.
2. The four composite scores were: Language, Visual Materials, Reading Comprehension, and Math.

Thus, the procedures outlined in the subject selection section, yielded three temporal groups; each student had four perceptual modality scores, a preferred temporal pace, and four academic achievement scores.

The Instruments

Edmonds Learning Style Identification Exercise (ELSIE): The Edmonds Learning Style Identification Exercise (ELSIE) was designed and standardized by Harry Reinert in 1975. It provides a profile of an individual's perceptual modalities based on the individual's response to fifty common English words.

The ELSIE is based on two premises (Reinert, 1976, p. 160):

> 1. Each individual is "programmed" to learn most efficiently in certain ways and less efficiently in others. It is a neurological programming.
>
> 2. One's pattern of internalization of his native language gives a profile of his learning style. The technique of internalizing individual words is the result of the programming of that person and not the result of training.

Since the native tongue is always learned in its oral form prior to the written form, the ELSIE is read aloud rather than being presented in writing. The ELSIE can be administered to groups or individually to persons seven years and older.

The four perceptual modalities measured by the Edmonds Learning Style Identification Exercise are: 1) visualization (pictures and images, 2) written word (spelling and reading), 3) listening (sounds and verbalization), and 4) activity (feelings, touch, and movement). The perceptual modality profile is constructed by tallying the individual's responses in each of the four perceptual modal-

ities. Answer and profile sheets are to be found in Appendices B and C respectively.

Overall reliability correlation for the ELSIE is r = .9845. By category the reliability coefficients are as follows (Reinert, 1982):

visualization	r	=	.99
written word	r	=	.95
listening	r	=	.988
activity	r	=	.97

Content validity was established through item analysis of an original list of eighty words. Fifty words were selected to be the most discriminating for each of the four categories. In addition, the words which had the highest and lowest percentage of responses in each of the four categories are (Reinert, 1976, p. 163):

Category	High	Low
Visualization	pool, baby, street, ocean, swim	hope, fear, shame truth, hate, good
Written Word	long, five, good law	chicken, baby, ocean running, swim
Listening	strange, justice, truth, think, law	pool, baby, ocean swim
Activity	happy, hate, love warm, hungry	five, bag, street, ground, paper

Item analysis of the 50 words compared to the original list of 80 words showed that the individual's profile remained constant even though item responses varied.

Permission to use the Edmonds Learning Style Identification Exercise was granted by the author, Harry Reinert, 1983.

The Metronome: A manual wind metronome was used to determine preferred temporal pace. Barsch (1974) has used the metronome to find individual temporal pace. He believes that people can identify with a metronomic rate in personal terms. According to Barsch (1974), these individual identifications with metronomic rates will approximate a normal distribution. That is, any given sample will have the greatest concentration of individuals in the medium range (72-120 b/m).

Most metronomes have 39 rates. The rates selected for the temporal pacing exercise are starred on the following chart. The number in parenthesis indicates the pace number on the temporal pacing exercise answer sheet (Appendix D). There are seven metronomic rates for each temporal group, thus yielding 21 metronomic rates for the exercise.

METRONOMIC RATES

Slow	Medium	Fast
40*(1)	72*(8)	126*(15)
42	76	132
44*(2)	80*(9)	138*(16)
46	84	144
48*(3)	88*(10)	162*(17)
50	92	160
52*(4)	96*(11)	168*(17)
54	100	176
56*(5)	104*(12)	184*(19)
58	108	192
60*(6)	112*(13)	200*(20)
63	116	208*(21)
66*(7)	120*(14)	
69		

The Iowa Tests of Basic Skills: The Iowa Tests of Basic Skills was used to assess academic achievement in the following four areas: language, reading comprehension, visual materials, and math. (The explanation for these four areas is given in Chapter I, Definition of Terms.)

The Iowa Tests of Basic Skills was authored by 12 individuals. The multilevel battery, available in two forms, is con-

structed to provide information on the status of student development in the basic skill areas of vocabulary and reading, language, work-study, and math. Between 16,000 and 19,000 pupils per grade were used to establish grade norms.

Internal consistency reliability coefficients for the five basic skill areas range from .89 to .96; composite reliability is .97 to .98 for all grades (Buros, 1978).

Content validity is based on over forty years of continuous research in the basic skills area. The skill items were determined by extensive and systematic consideration of courses of study, statements of authorities in educational methods, and recommendations from national curriculum groups. A thorough overview of contents of the test areas provide a valuable aid in determining the test's content validity for local settings.

Reviewers of the Iowa Tests of Basic Skills in Buros (1978) had reservations regarding the suggestions for skill remediations given in the teacher's guide. Nevertheless, the reviewers believed that the Iowa Tests of Basic Skills was carefully constructed and an excellent measure of basic skills.

Method of Testing

The exercises were administered in two sessions. The ELSIE was given during the first session, the temporal pacing exercise during

the second session. To ensure uniformity of presentation, instructions, test items, and metronomic rates were prerecorded. Sixth grade students completed the exercises in their homeroom classes. Seventh and eighth grade students completed the exercises in their English classes. The following is the tape transcript for the Edmonds Learning Style Identification Exercise. It was adapted from Reinert (1976, pp. 162-63):

> You are about to begin the Edmonds Learning Style Identification Exercise. This is not a test. There are no right or wrong answers. This exercise is designed to identify how individuals, such as yourself, learn most easily and most efficiently.
>
> You are going to hear 50 words, one at a time. Each word should be one which you have heard and sometimes say. As you hear each word, what goes on inside your head? You will probably find one of four things happening:
>
> 1. You will see a picture of something in your head, or
>
> 2. You will see in your head the letters of the alphabet that spell out the word, or
>
> 3. You may not see anything at all, but you just know what the word means when you hear it, or
>
> 4. You may, for just a second, feel something inside yourself, as if you were ready to make a fist, or feel bad, or good, or happy, or something like that.
>
> The main thing to be aware of is your immediate reaction. On your answer sheet are four letters for each word you will hear. Please read silently the instructions as I read them aloud.

Instructions: As each word is read, circle the letter indicating your response according to the following symbols:

P = See a picture of some object or activity in your mind.

W = See the word spelled out in your mind.

H = No picture in your mind; just hear the word.

F = Have a physical or emotional feeling about the word.

Remember to circle the first thing that happens to you as you hear each word. Never circle more than one letter for each word.

Let's try a few examples. Find the section on your answer sheet marked Practice Exercises. When I say the word Duck what is the first thing that happens to you? (Pause) If you saw in your head a picture of a duck, you would circle letter P. If you saw the letters d-u-c-k in your head, you would circle W. If you did not see anything, but you just heard the word and knew what it meant, you would circle letter H. Or if you felt like quacking, or if you felt like ducking down as if to avoid a flying object, you would circle letter F. Are there any questions? (Turn tape recorder off to answer any questions).

Ok, Let's try three more examples.

The second practice word is sink. Circle your first reaction in practice space number two.

Next, the third practice word is meat (or meet). Circle your response.

The last practice word, number four, is home.

You are now ready to start the main exercise. Each word will be read once. You will have ten seconds to circle your response. A beep will let you know that another word is going to be read.

Are there any questions? (Turn off the tape recorder, answer questions, then begin exercise.)

Now, let us begin. The first word is . . . .

1.	pool	26.	story
2.	tall	27.	happy
3.	summer	28.	ground
4.	long	29.	hate
5.	house	*30.	talk
6.	guilty	31.	ocean
7.	chicken	32.	good
8.	strange	33.	paint
9.	liar!	34.	down
*10.	beautiful	35.	freedom
11.	grass	36.	letter
12.	hope	37.	think
13.	yellow	38.	love
14.	fear	39.	running
15.	five	*40.	ugly
16.	God	41.	law
17.	read	42.	angry
18.	foot	43.	friend
19.	justice	44.	paper
*20.	baby	45.	warm
21.	enemy	46.	above
22.	bag	47.	kill
23.	shame	48.	swim
24.	street	49.	hungry
25.	truth	50.	bad

*Remember, circle the first thing that happens. There is no best way, only the best way for you.

You have now completed the Edmonds Learning Style Identification Exercise. Please wait for further instructions. Thank you.

The tape transcript for the Temporal Pacing Exercise is as follows:

This exercise will help you find your preferred temporal pace, that is, the rate(s) on the metronome with which you feel most comfortable. Perhaps in your music classes you have seen or heard a metronome. The metronome can be set to different speeds or beats per minute. In this exercise, you will hear 21 different beats. Some beats may feel too slow for you, some too

fast, and others will be just right. I want to know the beat(s) that are just right for you. This is how it will be done:

On your answer sheet find the practice exercise. I will play a beat for twenty (20) seconds. While the beat is going, I would like you to draw a square, one line for each beat. So, when four beats have sounded, you will have a square on your paper. Let's try the practice exercise (Recorder goes for twenty seconds while experimenter demonstrates on board). Ok, you should now have drawn some squares on your paper in the practice exercise section. If you liked that beat, put a star, or a check, or a word such as yes, ok, or great in the space marked reaction. If you did not like that beat put no, too slow, too fast, ugh, or something like that. You will probably find more than one beat that you really like. Since each beat will be played only once, it is important for you to put comments in the space marked reaction. Put more checks, or stars, or words by the most comfortable beats. At the end of the exercise, I will ask you to rate your first, second and third choices.

Before we being, I want to tell you that the beats will increase in speed from number one through number twenty-one. Any time that the beats are too fast for you, that is, you are not comfortable drawing the squares, you may stop. The purpose of this exercise is to help you find your comfortable rate. Do not worry if you do not do all the beats. In fact, most students do not finish. There is nothing special about finishing. What is special is finding your comfortable rate. Are there any questions? (Turn off tape-recorder to answer questions, then begin).

Ok, let us begin, Here is beat #1. (This procedure continues through beat #21. Experimenter checked from number 18 on to determine if there was still student participation.)

This is the end of the temporal pacing exercise. Go back over your answer sheet. Find the three beats you liked best. When you have found those three numbers, go back to page one. Put the three numbers in the proper place under Beats I Liked The Best.

Method of Analysis

The designs in this study were fixed models, that is, the experimenter had arbitrarily set (fixed) the levels of the factor to be studied (Courtney, 1982). The selected factors were: grades six, seven, and eight; sex; temporal groups designated as slow (40-70 b/m), medium (72-120 b/m), and fast (126-208 b/m); four perceptual modality scores (visualization, written word, listening, and activity); and academic achievement scores expressed as percentiles in language, reading comprehension, visual materials, and math.

The level of significance for this study was set at .05. The decision to retain or reject each of the five null hypotheses reflected this .05 criterion.

Null Hypothesis One: There are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) for the three temporal groups (slow, medium, fast). Null Hypothesis One was tested using the F statistic. The F statistic is a robust tool used in the comparison of variance and to test differences between means. The data in this hypothesis fulfill the requirements of the F statistic (Welkowitz, Ewen, and Cohen, 1976):

1. The data are equidistant interval.
2. Three means are being compared at a time.

Four, one-way analysis of variance tables were constructed summarizing the effect of temporal group on perceptual modality scores.

Null Hypothesis Two: There are no significiant relationships among demographic characteristics (sex, grade level) and temporal group (slow, medium, fast). Null Hypothesis Two was tested using the Chi-Square test. In this case, the Chi-Square tests indicated whether or not the expected proportion of students did, in fact, fall as expected. The data in this hypothesis fulfill the requirements of the Chi-Square considerations (Courtney, 1982):

1. The data are nominal.
2. More than one comparison is being made at a time with sex (grade level) and three temporal groups.

Chi-Square tables were constructed summarizing the effect of sex (grade level) on temporal group (slow, medium, fast).

Null Hypothesis Three: There are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) by demographic characteristics (sex, grade level). Null Hypothesis Three was tested using the two-way analysis of variance test. In this case, the two-way analysis of variance test indicated whether or not there was a difference between means for the two independent variables (sex, grade level). The data in this hypothesis fulfill the requirements for the two-way analysis of variance test (Courtney, 1982):

1. Dependent variables are normally distributed.

2. Variances are common or equal.

3. The data are equidistant interval.

Two-way ANOVA tables were constructed summarizing the effect of sex and grade level on perceptual modality mean scores (visualization, written word, listening, and activity).

Null Hypothesis Four: There are no significant relationships among perceptual modality scores (visualization, written word, listening, and activity) within each temporal group (slow, medium, fast). Null Hypothesis Four was tested using the Pearson Product Moment Correlation Coefficient. The data used in this hypothesis fulfill the requirements of the Pearson Product Moment Correlation Coefficient (Courtney, 1982):

1. The data are equidistant interval.

2. Two sets of data are being compared.

A correlation matrix was constructed for each of the three temporal groups which summarized the relationships among perceptual modality scores within each temporal group.

Null Hypothesis Five: There are no significant relationships among academic achievement scores (language, reading comprehension, visual materials, and math), preferred temporal pace, and perceptual modality scores (visualization, written word, listening, and activity). Null Hypothesis Five was tested using Multivariate Multiple Linear Regression. Multivariate refers to there being more than one dependent variable (the four academic achievement scores). Multiple

means more than one independent variable (preferred temporal pace and four perceptual modality scores). In Multivariate Multiple Linear Regression, all variables are entered at one time rather than in a step-wise fashion (Hull and Nie, 1981). This method is the best tool to show any relationships among the variables of academic achievement, temporal pace, and perceptual modality scores (Neter and Wasserman, 1974). Regression analysis tables were constructed for each dependent academic variable regressed on the four perceptual modality scores and preferred temporal pace.

Summary

The designs in this study were fixed models. Five null hypotheses were formulated to: 1) contrast perceptual modality scores and preferred temporal pace, and 2) compare perceptual modality scores, preferred temporal pace, and academic achievement scores.

The sample was composed of 613 sixth, seventh, and eighth grade students enrolled in Prineville Junior High School, Prineville, Oregon. Three instruments were used to collect the data: 1) the Edmonds Learning Style Identification Exercise yielded four perceptual modality scores (visualization, written word, listening, and activity), 2) the metronome was used to determine preferred temporal paces. Three temporal categories were established as slow (40-70 b/m), medium (72-120 b/m), and fact (126-208 b/m), and 3) current

(1983) composite scores on the Iowa Tests of Basic Skills ascertained academic achievement in the four areas of language, reading comphrehension, visual materials, and math.

To test the five null hypotheses, appropriate combinations of statistical tools were used. The statistical tools included one-way and two-way analysis of variance tests, Chi-Square, Pearson Product Moment Correlation Coefficient, and Multivariate Multiple Linear Regression. The level of significance for all decisions regarding the null hypotheses was .05.

CHAPTER IV

FINDINGS

This study was conducted during the Spring of 1983 at Prineville Junior High School, Prineville, Oregon. The purpose of the study was to investigate the relationships among perceptual modality, temporality, and academic achievement of selected middle school sixth, seventh, and eighth grade students. Six hundred and thirteen students participated in the study. Each student had the following set of scores:

1. Four perceptual modality scores (visualization, written word, listening, and activity) as ascertained by the Edmonds Learning Style Identification Exercise.
2. Preferred temporal pace expressed as the individual's most favored metronomic rate or beats per minute. For certain aspects of this study, the preferred temporal paces were categorized into three groups: slow (40-70 b/m), medium (72-120 b/m) and fast (126-208 b/m).
3. Four academic achievement scores (composite percentiles in language, reading comprehen-

sion, visual materials, and math) as measured by the Iowa Tests of Basic Skills.

These set of scores were then analyzed using appropriate statistical tools.

Analysis Procedures

Five null hypotheses were formulated in order to assess the relationships among perceptual modality, temporal pace, and academic achievement.

A one-way analysis of variance test was used to determine differences among perceptual modality mean scores for each temporal group. The Chi-Square test assessed relationships between sex, grade level, and the three temporal groups. A two-way analysis of variance was used to determine differences in perceptual modality mean scores by sex and grade level. The Pearson Product Moment Correlation Coefficient ascertained relationships among perceptual modality scores within each temporal group. A Multivariate Multiple Linear Regression analysis determined relationships among academic achievement scores, preferred temporal pace, and perceptual modality scores.

Each null hypothesis is discussed in the following sections. The probability level of at least .05 was used as the criterion for statistical significance.

Null Hypothesis One

Null Hypothesis One states that there are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) for the three temporal groups (slow, medium, fast). To test this null hypthesis, four, one-way analysis of variance tests were conducted.

Table 1 presents the four perceptual modality mean scores for each of the three temporal groups.

One of the characteristics of the Edmonds Learning Style Identification Exercise is that it gives a profile of the four perceptual modality scores in relationship to a previously normed value (see Chapter III, Instruments, and Appendix C). The discussion of Table 1 will include reference to this normed value.

The visualization mean scores for the three temporal groups were: slow 16.02, medium 17.00, and fast 16.88. The medium temporal group has a slightly higher mean score than the fast temporal group. The normed value for visualization is 17.00. The medium temporal group has exactly this value with both the fast and slow temporal groups slightly below this value.

The written word mean scores for the three temporal groups were: slow 10.19, medium 9.88, and fast 9.22. The slow temporal group had the highest mean score with the medium group second, and the fast temporal group third. The normed value for written word is

MEAN SD SE	PERCEPTUAL MODALITY			
	Visualization	Written Word	Listening	Activity
SLOW Temporal Group (40-70 b/m)	16.02 6.56 .63	10.19 6.21 .60	10.92 8.06 .78	12.86 7.59 .73
MEDIUM Temporal (72-120 b/m)	17.00 6.02 .46	9.88 5.36 .40	10.28 6.75 .51	12.80 6.26 .48
FAST Temporal Group (126-208 b/m)	16.88 5.92 .32	9.22 6.20 .34	11.67 7.79 .43	12.16 6.68 .37
Ungrouped	16.76	9.57	11.15	12.46

SD Standard Deviation
SE Standard Error

Count: Slow 107 subjects
Medium 172 subjects
Fast 334 subjects

Table 1. Perceptual Modality Mean Scores for the Slow, Medium and Fast Temporal Groups

11. All temporal groups fall below this value.

The listening mean scores for the three temporal groups were: slow 10.92, medium 10.28, and fast 11.67. The fast temporal group has the highest mean score with the medium temporal group having the lowest. The listening normed value is 11 which approximates the slow temporal group. The medium temporal group falls below the normed value and the fast temporal group above the normed value.

The activity mean scores for the three temporal groups were: slow 12.86, medium 12.80, and fast 12.16. The slow temporal group had the highest mean value, then medium temporal group, followed by the fast temporal group. All temporal group mean scores are above the normed value of 10.

A quick overview of Table 1 reveals extremely large standard deviations. Large standard deviations are derived from large variances, which are products of wide ranges in scores.

Table 1 presented the mean values for each of the temporal groups in the four perceptual modalities. Tables 2, 3, 4, and 5 present the analysis of variance tests to determine the effect of temporal group on perceptual modality mean scores.

Table 2 presents a computed F value of 1.00. The tabular F value for 2 and 610 degrees of freedom at the .05 level of significance is 3.02. Because the computed F value is less than the tabular F value, the differences between temporal group means for visualization is due to chance variation and does not represent real

differences between mean scores.

Table 3 presents a computed F value of 1.36. To be significant, the computed F value would have to be at least 3.02. The results indicate that the differences between temporal group means for written word scores is due to chance.

Table 4 presents a computed F value of 1.00. Again, the F value for the .05 level of significance is 3.02. The computed F value is less than the tabular F value. Variations among the three temporal group mean scores for listening are not significant.

Table 5 indicates a computed F value of .74. This value does not approach significance. The variations in activity mean scores for the three temporal groups do not represent real differences.

In summary, Table 1 presented modality mean scores for the three temporal groups. Tables 2, 3, 4, and 5 showed computed F values to be less than the tabular F value for 2 and 610 degrees of freedom and the required .05 level of significance. Therefore, there are no significant differences in perceptual modality means scores (visualization, written word, listening, and activity) for the three temporal groups (slow, medium, fast).

Source of Variation	df	ss	ms	Computed F	Significance of F
Between Groups	2	73.53	36.76	1.00	--
Within Groups	610	22431.17	36.77		
Total	612	22504.70			

Table 2. One-way ANOVA Table Summarizing the Effect of Temporal Group on Visualization Mean Scores

Source of Variation	df	ss	ms	Computed F	Significance of F
Between Groups	2	97.57	48.79	1.36	--
Within Groups	610	21834.30	34.79		
Total	612	21931.87			

Table 3. One-way ANOVA Table Summarizing the Effect of Temporal Group on Written Word Mean Scores

Source of Variation	df	ss	ms	Computed F	Significance of F
Between Groups	2	227.92	113.96	1.99	--
Within Groups	610	34868.28	57.16		
Total	612	35096.19			

Table 4. One-way ANOVA Table Summarizing the Effect of Temporal Group on Listening Mean Scores

Source of Variation	df	ss	ms	Computed F	Significance of F
Between Groups	2	66.91	33.45	.74	--
Within Groups	610	27671.36	45.36		
Total	612	27738.27			

Table 5. One-way ANOVA Table Summarizing the Effect of Temporal Group on Activity Mean Scores

Null Hypothesis Two

Null Hypothesis Two states that there are no significant relationships among demographic characteristics (sex, grade level) and temporal group (slow, medium, fast). To test this hypothesis, Chi-Square tests were used.

Table 6 presents the effect of sex on preferred temporal pace. As Table 6 demonstrates, there is a high concentration of boys and girls in the fast temporal group. The fast temporal group accounts for 54.5 percent of the total observations, while the slow and medium groups account for 28.1 and 17.5 percent respectively. These findings are contrary to Barsch's stipulations (see Chapter III, The Instruments). Barsch (1974) believed that in any given sample the greatest concentration of individuals would be in the medium range. As Table 6 demonstrated, the highest concentration in this middle school sample was in the fast temporal range.

However, the concern for this hypothesis was on the proportion of boys to girls within each temporal group. In the slow temporal group the proportion of boys to girls was approximately equal, 56 to 51. In the medium temporal group the distribution of boys to girls was 101 to 71. In the fast temporal group the proportion was equal, 167 to 167. For the study, the number of boys to girls was 324 to 289.

Count Column %	Sex Boy	 Girl	Row Total and %
SLOW (40-70 b/m)	56 17.3	51 17.6	107 17.5
MEDIUM (72-120 b/m)	101 31.2	71 24.6	172 28.1
FAST (126-208 b/m)	167 51.5	167 57.8	334 54.5
Column Total	324 52.9	287 47.1	613 100.0

Computed X^2 = 3.479, df = 2, p = N.S.

Table 6. Chi-Square Table Summarizing the Effect of Sex on Preferred Temporal Pace

The computed Chi-Square value for Table 6 is 3.478 with two degrees of freedom. The tabular value at the .05 level of significance is 5.991. These findings indicate that the distribution of boys and girls within each temporal group is as expected. The proportion of boys to girls in each temporal group is not statistically significant.

Table 7 presents the cross tablulation of temporal groups by grade level. Table 7 indicates a higher concentration of sixth graders in the slow temporal group than for grades seven and eight. Within the medium temporal group, there is a higher concentration of eighth graders, followed by sixth graders, then seventh graders. Within the fast temporal group, there is a slightly higher concentration of seventh graders than eighth, with a marked difference for sixth graders.

The computer Chi-Square value for Table 7 is 9.918 with four degrees of freedom. The tabular Chi-Square value at the .05 level of significance is 9.488. This means that within each temporal group, the proportion of sixth, seventh, and eighth grade students is not as expected. It would appear that the classifications of grade level and temporal group are not independent of one another. Proportionally there are more sixth graders in the slow temporal group. The eighth grade has very few individuals in the slow temporal group. There are more eighth graders in the medium temporal group than either sixth or seventh graders, with a marked difference

Count Column %	Grade Level 6	7	8	Row Total and %
Slow (40-70 b/m)	46 22.2	35 17.5	26 12.6	107 17.5
Medium (72-120 b/m)	59 28.5	47 23.5	66 32.0	172 28.1
Fast (126-208 b/m)	102 49.3	118 59.0	114 55.3	334 54.5
Column Total	207 33.8	200 32.6	206 33.6	613 100

Computed X^2 = 9.918, df = 4, $p < .05$

Table 7. Chi-Square Table Summarizing the Effect of Grade Level on Preferred Temporal Pace

in the seventh grade. As mentioned previously (Table 6 discussion), the fast temporal group had the highest concentration of individuals. The seventh grade had the highest concentration in the fast temporal group, followed closely by the eighth grade and lastly the sixth grade. From these findings (Table 7 results), it is apparent that a significant relationship exists between grade level (6, 7, 8) and temporal group (slow, medium, fast).

In summary, Tables 6 and 7 presented the effect of sex and grade level on preferred temporal pace. The Chi-Square computed values indicated the following results:

1. The distribution of boys to girls within each temporal group fell within the expected proportion. That is, there were no significant relationships between sex and temporal group.
2. The proportion of sixth, seventh, and eighth grade students within each temporal group was not normally distributed. That is, grade level is significantly related to temporal group.

Null Hypothesis Three

Null Hypothesis Three states that there are no significant differences in perceptual modality mean scores (visualization,

written word, listening, and activity) by demographic characteristics (sex, grade level). A two-way analysis of variance test was conducted on each perceptual modality mean scores for the three temporal groups to determine whether or not the differences between sets of means was due to chance variation, or if they represented real differences which were not due to chance. For clarity and ease of discussion, each perceptual modality mean score will be reported and discussed separately.

Table 8 presents the visualization mean scores by sex and grade level. Note that the males have a higher visualization mean score at each grade level. The sixth grade males have the highest score with 18.21, followed by eighth grade males at 17.38, with the seventh grade males scoring 16.53. The highest visualization mean score for females is at the sixth grade level with 16.67, followed by the seventh grade females with 15.91 and eighth grade females with 15.56.

The computed F value is 7.413 for the sex effect on visualization mean scores (Table 9). The critical value from the F table for 1 and 607 degrees of freedom at the .05 level of significance is 3.85. Since the computed F of 7.413 is greater than this value, there is a difference in performance on visualization responses according to sex. Males score higher, that is, give more visualization responses than do females to the words presented in the Edmonds Learning Style Identification Exercise.

Sex	Grade Level 6	7	8	Row Total
Male	18.21	16.53	17.38	17.41
Female	16.67	15.91	15.56	16.04
Column Total	17.52	16.22	16.53	16.76

Table 8. Visualization Mean Scores by Sex and Grade Level

Source of Variation	df	ss	ms	Computed F	Significance of F
Sex	1	268.76	268.76	7.413	.007
Grade	2	168.37	84.18	2.322	--
Interaction (sex x grade)	2	39.82	19.91	.549	--
Error	607	22006.30	36.25		
Total	612	22504.70	36.77		

Table 9. Two-way ANOVA Table Summarizing the Effect of Sex and Grade Level on Visualization Mean Scores

Table 9 presents a computed F value for the grade level effect on visualization mean scores is 2.322. The tabular F value for 2 and 607 degrees of freedom is 3.00. There is not sufficient reason to believe that individuals in the three grade levels perform differently on visualization responses.

Referring to Table 9, the tabular F value for the interaction effect of sex and grade level, for 2 and 607 degrees of freedom, is 3.00. The computed F value for the interaction effect is .549. Since the computed F value is less than the tabular F value, there is no interaction effect of sex and grade level on visualization mean scores.

To summarize visualization mean scores, it was found that: 1) there was a significant sex effect; males score higher on visualization responses, 2) there was no significant grade level effect, and 3) there was no interaction effect between sex and grade level.

Table 10 presents the written word mean scores by sex and grade level. As Table 10 demonstrates, females at each grade level have a higher mean score than do males. Seventh grade females have the highest score with 10.23, followed by seventh grade males at 9.99, eighth grade females 9.87, eighth grade males 9.78, sixth grade females 9.02, sixth grade males 8.62.

The computed F value is .261 for the sex effect on written word mean scores (Table 11). The critical value from the F table for 1 and 607 degrees of freedom is 3.85. Since the computed F is less

than the tabular F, there is not sufficient reason to believe that the two sexes perform differently in their written word responses.

The computed F value for the grade level effect on written word mean scores (Table 11) is 2.613. The tabular F value for 2 and 607 degrees of freedom is 3.00. As the computed F value is less than the critical value, there is no significant difference in the performance of individuals in the three grade levels for written word responses.

The tabular F value for the interaction of sex and grade level is also 3.00. The computed F value for the interaction effect is .031 (Table 11). Since the computed F value is less than the tabular value, there is no interaction effect between sex and grade level on written word mean scores.

To summarize written word mean scores it was found that there was no significant sex effect, grade level effect, nor was there an interaction effect between sex and grade level.

Table 12 presents the listening means scores by sex and grade level. It indicates that females in grades six and eight have higher mean scores than do males in those same grade levels. Seventh grade males score higher than do seventh grade females. The rank order of the scores are: eighth grade females 11.97, sixth grade females 11.48, seventh grade males 11.44, seventh grade females 11.20, eighth grade males 10.89, and sixth grade males 10.14. The statistical significance of these mean scores is

Sex	Grade Level 6	7	8	Row Total
Male	8.62	9.99	9.78	9.44
Female	9.02	10.23	9.87	9.73
Column Total	8.80	10.11	9.83	9.57

Table 10. Written Word Mean Scores by Sex and Grade Level

Source of Variation	df	ss	ms	Computed F	Significance of F
Sex	1	9.33	9.33	.261	--
Grade	2	187.02	93.51	2.613	--
Interaction (sex x grade)	2	2.235	1.118	.031	--
Error	607	21725.94	35.79		
Total	612	21931.87	35.84		

Table 11. Two-way ANOVA Table Summarizing the Effect of Sex and Grade Level on Written Word Mean Scores

presented in Table 13.

The computed F value is 1.402 for the sex effect on listening mean scores (Table 13). The critical value from the F table for 1 and 607 degrees of freedom is 3.85. Since the computed F is less than this value, there is not sufficient reason to believe that the two sexes perform differently in their listening responses to the words presented.

The computed F value for the grade level effect on listening mean scores as .386 (Table 13). The tabular F value for 2 and 607 degrees of freedom is 3.00. As the computed F value is less than the critical value, there is no significant difference in the performance of individuals in the three grade levels for listening responses.

Table 13 indicates a computed F value of 1.402 for the interaction effect. As in the grade level effect, the tabular F value is 3.00. The computed F value is less than the tabular F value, therefore, there is no interaction effect between sex and grade level on listening mean scores.

To summarize, it was found that there was no significant sex effect, grade level effect, nor was there an interaction effect between sex and grade level for listening mean scores.

Mean scores for activity responses were computed by sex and grade level. This information is presented in Table 14. As Table 14 illustrates, females in grades seven and eight have slightly

Sex	Grade Level 6	7	8	Row Total
Male	10.14	11.44	10.89	10.80
Female	11.48	11.20	11.97	11.55
Column Total	10.74	11.32	11.39	11.15

Table 12. Listening Mean Scores by Sex and Grade Level

Source of Variation	df	ss	ms	Computed F	Significance of F
Sex	1	80.61	80.61	1.402	--
Grade	2	44.42	22.21	.386	--
Interaction (sex x grade)	2	72.52	36.26	.631	--
Error	607	34889.22	57.48		
Total	612	35096.19	57.35		

Table 13. Two-way ANOVA Table Summarizing the Effect of Sex and Grade Level on Listening Mean Scores

higher mean scores than do males in the same grades. The highest mean score is for sixth grade males with 12.97, followed by sixth grade females 12.73, seventh grade females 12.57, eighth grade females 12.56, eighth grade males 12.03, and seventh grade males 11.88. Table 15 presents the two-way ANOVA results for the testing of these means.

The computed F value is .353 for the sex effect on activity mean scores (Table 15). The critical value from the F table is 3.85. Since the computed F is less than this value, there is not sufficient reason to believe that the two sexes perform differently in their activity responses.

The computed F value for the grade level effect on activity means scores is .526 (Table 15). The tabular F value for the grade level effect is 3.00. The computed F value is less than the critical value. There is no significant difference in the performance of individuals in the three grade levels for activity responses.

The computed F value is .277 for the interaction effect (Table 15). As with grade level effect, the critical value is 3.00. Since the computed F value is less than the critical F value, there is no interaction effect between sex and grade level on activity mean scores.

To summarize activity mean scores, it was found that there was no significant sex effect, grade level effect, nor was there an

Sex	Grade Level 6	7	8	Row Total
Male	12.97	11.88	12.03	12.32
Female	12.73	12.57	12.56	12.62
Column Total	12.86	12.22	12.28	12.46

Table 14. Activity Mean Scores by Sex and Grade Level

Source of Variation	df	ss	ms	Computed F	Significance of F
Sex	1	16.06	16.06	.353	--
Grade	2	47.88	23.94	.526	--
Interaction (sex x grade)	2	25.23	12.61	.277	--
Error	607	27645.75	45.55		
Total	612	27738.27	45.32		

Table 15. Two-way ANOVA Table Summarizing the Effect of Sex and Grade Level on Activity Mean Scores

interaction effect between sex and grade level.

To review the findings of the effect of sex and grade level on perceptual modality scores, it was found:

1. There was a significant difference between sexes for visualization mean scores. That is, males scored significantly higher in visualization responses.
2. There was no significant difference between the sexes for written word, listening, and activity mean scores. That is, sex did not influence the responses for these perceptual modalities.
3. There was no significant grade level effect for visualization, written word, listening, and activity mean scores. That is, there was no significant difference in the performance of individuals in grades 6, 7, and 8 for perceptual modality mean scores.
4. There was no significant interaction effect. That is, there was no interaction effect between grade level and sex for visualization, written word, listening, or activity mean scores.

Null Hypothesis Four

Null Hypothesis Four states that there are no significant relationships among perceptual modality scores (visualization, written word, listening, and activity) within each temporal group (slow, medium, fast). To test this hypothesis, the Pearson Product Moment Correlation Coefficient was used. Table 16 presents the correlation matrices summarizing the relationships among perceptual modality scores within the three temporal groups.

Table 16 indicates that there are six distinct paired *r* values representing the correlation between the four dependent variables of visualization, written word, listening, and activity taken two at a time for each temporal group. The correlation values for the slow temporal group range from .21 to .47. The strength of these values is low, indicating a definite but small relationship.

As would be expected with low correlation values for the slow temporal group, the size of the relationship or percentage of commonality is also small. Given the correlation range of .21 to .47,the percentage of commonality, the amount of overlap between any variable set, ranges from 4 to 22 percent. Thus, the common factor variance shared by any set being considered is slight.

All signs of the paired variables in the slow temporal group, except when a variable is paired with itself, are negative. This negative directional relationship would be important had there been

Temporal Group		PERCEPTUAL MODALITY V	WW	L	A
SLOW	V	1.00	-.21	-.42	-.25
(40-70 b/m)	WW	-.21	1.00	-.27	-.34
107	L	-.42	-.27	1.00	-.47
Subjects	A	-.25	-.34	-.47	1.00
MEDIUM	V	1.00	-.32	-.28	-.37
(72-120 b/m)	WW	-.32	1.00	-.37	-.15
172	L	-.28	-.37	1.00	-.48
Subjects	A	-.37	-.15	-.48	1.00
FAST	V	1.00	-.21	-.46	-.15
(126-208 b/m)	WW	-.21	1.00	-.32	-.37
334	L	-.46	-.32	1.00	-.45
Subjects	A	-.15	-.37	-.45	1.00

V = visualization
WW = Written Word
L = Listening
A = Activity

Table 16. Correlation Matrices Summarizing the Relationships Among Perceptual Modality Scores Within the Slow, Medium, and Fast Temporal Groups

high correlation values and corresponding high percentage of commonality values.

Table 16 indicates that the correlation values for the medium temporal group range from .15 or .48. The strength of these values is low, indicating a definite but small relationship.

Low correlation values yield low percentage of commonality values. Given the correlation range of .15 to .48, the percentage of commonality ranges from 2 to 23 percent. The common factor variance shared by any set being considered is slight.

All signs of the paired variables are negative. This negative directional relationship is of no significance because of the low correlation and low percentage of commonality values.

For the fast temporal group, Table 16 indicates that the correlation values range from .15 to .46. The strength of these values are low and not statistically meaningful.

The percentage of commonality values for the fast temporal group range from 2 to 21 percent. The common factor variance is almost negligible.

The negative directional relationship shared by all paired variables is of no significance.

In summary, Table 16 presented the correlation matrices for the pairing of perceptual modality scores within each temporal group. No meaningful relationships were found. There are no significant relationships among perceptual modality scores (visualization,

written word, listening, and activity) within each temporal group (slow, medium, fast).

Null Hypothesis Five

Null Hypothesis Five states that there are no significant relationships among academic achievement scores (language, reading comprehension, visual materials, and math), preferred temporal pace, and perceptual modality scores (visualization, written word, listening, and activity). To test this hypothesis, Multivariate Linear Multiple Regression analysis was used. In the regression analysis, the following scores were used: 1) academic achievement scores expressed as composite percentiles on the Iowa Tests of Basic Skills in language, reading comprehension, visual materials, and math; 2) preferred temporal pace, the most favored metronomic rate expressed in beats per minute; 3) perceptual modality raw scores in the four areas of visualization, written word, listening, and activity. Only those subjects who had a complete set of scores for all areas were used. Therefore, in the regression analysis, the sample size was 544 subjects.

Table 17 reports the regression analysis results for the dependent variable, language score, on the four perceptual modality scores and the preferred temporal pace. Table 17 reports a computed

F value of 2.89 with a significance of .014. This suggests that there is a regression relationship among language scores, perceptual modality scores and preferred temporal pace. However, the square of multiple correlation coefficient (R) for the language variable is .026. This reported value is called the value of determination (Neter and Wasserman, 1974) and is used in deciding the meaningfulness of any regression relationship found. The value of .026 in Table 17 indicates that only 3 percent of the significance found is due to the covariates listed. So, although the computed F value was significant at the .014 level of significance, this significance was not meaningful due to the small square of multiple R value. In all probability, the computed F value was significant due to the large sample size. When the sample size is large, such as 544 in this study, the large degrees of freedom (5, 538) make the analysis sensitive to small regression relationships which, although present, are not meaningful. In this study, this was true.

Table 18 reports the regression analysis for within cells of the dependent variable language with five covariates. As Table 18 indicates, that of the five independent variables, temporal paceappears to have a greater influence on language achievement scores than do any of the perceptual modality scores. Had the R value in Table 17 been meaningful, temporal pace could have been the factor identified in this study as most influential on language achievement scores.

Source of Variation	df	ss	ms	Computed F	Significance of F
Regression	5	10057.30	2011.46	2.89	.014
Error	538	374765.42	696.59		
Total	543	384822.72			

Square of Multiple Correlation Coefficient (R) for Language Variable = .026

Table 17. Regression Analysis Table for the Regression of Language Composite Percentile Scores on Perceptual Modality Scores and Preferred Temporal Pace

Variable	Regression Coefficient	Beta	Standard Error	T Value	Significance of T
Visualization	.808	.182	1.07	.754	.451
Written Word	.944	.213	1.06	.882	.378
Listening	.965	.272	1.06	.909	.363
Activity	.927	.235	1.07	.865	.387
Temporal Pace	.727	.156	.19	3.650	.0002

Table 18. Regression Coefficients for Language Scores with Perceptual Modality Scores and Preferred Temporal Pace

Table 19 reports the regression analysis results for the dependent variable, reading comprehension score, on the four perceptual modality scores and the preferred temporal pace. Table 19 reports computed F value of 2.17 which is significant at the .056 level of significance. The computed F value does not meet the criterion of the .05 level of significance. The square of multiple R for reading comprehension is .019. Not only is the computed F value not significant, the square of multiple R value indicates weak influence of the identified covariates on reading comprehension scores.

Table 20 reports the regression analysis for within cells of the dependent variable reading comprehension with five independent variables. As Table 20 indicates, that of the five independent variables, temporal pace would have had the greater influence on reading comprehension scores had significance been found in the computed F value and the square of multiple R.

Table 21 presents the regression analysis for the dependent variable, visual materials score, on the four perceptual modality scores and preferred temporal pace. The computed F value of 1.56 is not significant. The square of multiple R for visual materials is .014. This data suggests that there is no linear relationship existing among visual materials, preferred temporal pace, and perceptual modality scores.

Table 22 presents the regression analysis for within cells of

Source of Variation	df	ss	ms	Computed F	Significance of F
Regression	5	7021.30	1404.26	2.17	.056
Error	538	348021.44	646.88		
Total	543	355042.74			

Square of Multiple Correlation Coefficient (R) for Reading Comprehension Variable = .019

Table 19. Regression Analysis Table for the Regression of Reading Comprehension Composite Percentile Scores on Perceptual Modality Scores and Preferred Temporal Pace

Variable	Regression Coefficient	Beta	Standard Error	T Value	Significance of T
Visualization	1.196	.281	1.03	1.158	.247
Written Word	1.128	.265	1.03	1.094	.274
Listening	1.327	.389	1.02	1.297	.195
Activity	1.348	.355	1.03	1.305	.192
Temporal Pace	.545	.121	.19	2.838	.005

Table 20. Regression Coefficients for Reading Comprehension Scores with Perceptual Modality Scores and Preferred Temporal Pace

the dependent variable visual materials with five covariates. Table 22 demonstrates that of the five variables regressed with visual materials, temporal pace is the only one with a significant T-value. It is possible, had Table 21 shown a significant computed F value and the square of multiple R been meaningful, that the significance could have been accounted for by temporal pace.

Table 23 presents the regression analysis results for the dependent variable, math score, on the four perceptual modality scores and preferred temporal pace. The computed F value of 2.37 is significant at the .038 level. Again, the value suggests that there is a significant linear relationship among math scores, perceptual modality scores, and preferred temporal pace. However, the square of multiple R value is .021 which means that of those variables identified, only 2 percent is accountable by the identified variables.

Table 24 presents the regression analysis for within cells of the dependent variable math score with five variables. As before, Table 24 demonstrates that of the five independent variables, temporal pace would have had a greater influence on math achievement scores had the square of multiple R been meaningful.

To summarize Null Hypothesis Five, it was found that there were no significant relationships among academic achievement scores, preferred temporal pace, and perceptual modality scores. While two computed F values were found to be significant, the square of mul-

Source of Variation	df	ss	ms	Computed F	Significance of F
Regression	5	5922.70	1184.54	1.56	.169
Error	538	407696.40	757.80		
Total	543	413619.10			

Square of Multiple Correlation Coefficient (R) for Visual Materials Variable = .014

Table 21. Regression Analysis Table for the Regression of Visual Materials Composite Percentile Scores on Perceptual Modality Scores and Preferred Temporal Pace

Variable	Regression Coefficient	Beta	Standard Error	T Value	Significance of T
Visualization	.315	.068	1.11	.282	.778
Written Word	.551	.120	1.11	.494	.621
Listening	.485	.132	1.10	.438	.661
Activity	.451	.110	1.11	.404	.686
Temporal Pace	.542	.112	.20	2.610	.009

Table 22. Regression Coefficients for Visual Materials Scores with Perceptual Modality Scores and Preferred Temporal Pace

Source of Variation	df	ss	ms	Computed F	Significance of F
Regression	5	8474.75	1694.95	2.37	.038
Error	538	384815.26	715.27		
Total	543	393290.01			

Square of Multiple Correlation Coefficient (R) for Math Variable = .021

Table 23. Regression Analysis Table for the Regression of Math Composite Percentile Scores on Perceptual Modality Scores and Preferred Temporal Pace

Variable	Regression Coefficient	Beta	Standard Error	T Value	Significance of T
Visualization	.566	.126	.20	.521	.602
Written Word	.701	.156	1.08	.647	.518
Listening	.792	.221	1.08	.736	.462
Activity	.649	.162	1.07	.598	.550
Temporal Pace	.637	.135	1.08	3.156	.002

Table 24. Regression Coefficients for Math Scores with Perceptual Modality Scores and Preferred Temporal Pace

tiple R values were not meaningful. Within cell regression of the dependent academic achievement scores with the five covariates revealed that temporal pace had the greater influence, but that this influence was not meaningful due to the square of multiple R values.

Summary of the Findings

The data collected in this study was reported and analyzed in this chapter. Five null hypotheses were formulated to investigate the relationships among perceptual modality, temporality, and academic achievement. One-way and two-way analysis of variance tests, Chi-Square tests, Pearson Product Moment Correlation Coefficients, and Multivariate Multiple Linear Regression tests were used appropriately. Using .05 as the criterion for statistical significance, the following results were reported:

1. There were no significant differences in visualization, written word, listening, and activity mean scores for the slow, medium, and fast temporal groups.

2. There was no significant relationships between sex and temporal grouping (slow, medium, and fast).

3. A significant relationship existed between grade level (6, 7, 8) and temporal group (slow, medium, fast). There was a higher concentration of sixth graders in the slow temporal group; within the medium temporal group there were fewer seventh graders than either sixth or eighth graders; and within the fast temporal group, there were more seventh graders and fewer sixth graders.
4. There was a significant difference between the sexes for visualization mean scores. Males scored significantly higher in visualization responses.
5. There was no significant difference between the sexes for written word, listening, and activity mean scores.
6. There was no significant difference in the performance of individuals in grades 6, 7, 8 for perceptual modality mean scores.
7. There was no significant interaction effect between grade level and sex for the four perceptual modality mean scores.
8. No significant relationships among perceptual modality scores within each temporal group

were found.

9. There were no significant regression relationships among the four academic achievement scores, preferred temporal pace, and the four perceptual modality scores.

Based on the findings of this study, implications for academic counseling of middle school students are examined in the following chapter. In addition, recommendations for further study are considered.

CHAPTER V

SUMMARY, IMPLICATIONS, RECOMMENDATIONS

Restatement of the Problem

Educators are constantly searching for better ways to facilitate the mastery of the basic skills by students. Basic skill mastery is reflected in teacher assessment techniques and formal assessment such as academic achievement tests. Not infrequently, administrators, parents, and the public judge the effectiveness of teaching by the performance of students on standardized tests. Thus, students' academic achievement scores become one avenue of educational accountability by the school to the public.

School counselors are very familiar with poor academic achievers. Indeed, it is the student who is not achieving and/or who is often a behavioral problem that is most frequently referred to the counselor for individual attention. Teachers often do not have the time nor the patience to teach and reteach each student who needs individualized attention.

As beneficial as it might be to help each of these students individually, the school counselor should not attempt to work in isolation. They must involve teachers in counseling activities, and counselors must seek to involve themselves in school-wide curriculum

and instruction. School counselors can share their knowledge regarding individual differences in student learning performance with teachers.

That students learn differently is often recognized but not always accommodated in the classroom. What educator has not witnessed any of the following observable characteristics in their students? (Illustrated characteristics are verifiable by Barsch, 1974, p. 5 - 9; and Barbe, Swassing, and Milone, 1979, p. 44 - 45.)

Student V: Stares out window, frequently closes eyes, generally unaware of sounds, likes bright colors, interested in shapes, remembers faces but not names, likes films or other visual materials.

Student A: Hums, talks to self, cannot wait to talk, easily distracted by sounds, subvocalizes, remembers names but forgets faces, speech is punctuated with sound imitations.

Student K: Fidgets, finds reasons to move, cannot wait to try things out or to feel, touch or manipulate objects, plays with wisps of own hair, gestures when speaking, does not listen well, remembers best what was done.

Student S: Movements are in slow motion, no amount of prodding will get things done quicker, appears laid-back, easy going, frequently feels nagged by others who want him/her to do things faster, speech is slow and deliberate.

Student F: Everything needed to be done yesterday, movement is quick, efficient, speech is rapid, taps foot or fingers, easy to involve in activity but soon bored.

These observable characteristics are familiar to educators. Perhaps the reader has identified with some of the characteristics. These characteristics are present in every classroom every school day. Unfortunately, many of these behaviors are noted by teachers because they find them distracting. Yet, each of these behaviors are clues as to how students are taking in information and how the students are relating to time. Student V is a visual learner; Student A is auditory; Student K is kinesthetic; Student S is a slow temporal paced individual; and Student F is fast temporal paced.

The main objective of this study was to explore the possible relationship among perceptual modality, temporality, and academic achievement. The second objective was to develop implications for academic counseling based on the findings of this study.

Summary of the Study

The study was conducted at Prineville Junior High School during the Spring of 1983. Six hundred and thirteen students in grades six, seven, and eight participated.

Three sets of scores were obtained for each participant. The Edmonds Learning Style Identification Exercise yielded four perceptual modality scores: visualization, written words, listening, and activity. Temporal pace was assessed using a metronome, and the

preferred temporal pace categorized as either slow (40-70 b/m), medium (72-120 b/m), or fast (126-208 b/m). The Iowa Tests of Basic Skills measured academic achievement in language, reading comprehension, visual materials, and math. These sets of scores were analyzed using appropriate statistical tools.

Analysis of Data

Statistical tools included: analysis of variance tests, Chi-Square tests, Pearson Product Moment Correlation Coefficients, and Multivariate Multiple Linear Regression tests. The results were used to determine relationships among temporality, perceptual modality, and academic achievement. The probability level of at least .05 was the criterion for statistical significance. The findings for the five null hypotheses were:

HO_1: There are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) for the three temporal groups (slow, medium, fast).

Results: Null Hypothesis One is retained.

HO_2: There are no significant relationships between demographic characteristics (sex, grade level) and temporal group (slow, medium, fast).

Results: Null Hypothesis Two is retained for sex and temporal group.

Null Hypothesis Two is rejected for grade level and temporal group. A significant difference exists between grade level (6, 7, 8) and temporal group. There are more individuals in the slow temporal group in the sixth grade than in the seventh or eighth.

HO_3: There are no significant differences in perceptual modality mean scores (visualization, written word, listening, and activity) by demographic characteristics (sex, grade level).

Results: Null Hypothesis Three is rejected for sex and visualization mean scores. Males scored significantly higher in visualization responses.

Null Hypothesis Three is retained for sex and the perceptual modality mean scores of written word, listening, and activity.

Null Hypothesis Three is retained for grade level and perceptual modality mean scores.

Null Hypothesis Three is retained for the interaction of grade level and sex on perceptual modality mean scores.

HO_4: There are no significant relationships among perceptual modality scores (visualization, written word, listening, and activity) within each temporal group (slow, medium, fast).

Results: Null Hypothesis Four is retained.

HO_5: There are no significant relationships among academic achievement scores (language, reading comprehension, visual materials, and math), preferred temporal pace, and perceptual modality scores (visualization, written word, listening, and activity).

Results: Null Hypothesis Five is retained.

The implications these findings have for the academic counseling of students at the middle school level is explored in the following section. The categories of academic achievement, perceptual modality, and temporality will be discussed, as well as recommendations for further study.

Academic Achievement

Null Hypothesis Five found no significant relationships among perceptual modality, temporality, and academic achievement as measured by the instruments in this study.

Regression analysis within cells showed that no perceptual modality variable was significant in accounting for academic achievement. The difficulty may be that the perceptual modalities as measured by the Edmonds Learning Style Identification Exercise are not discrete. The instrument provides a profile of modalities and avoids labeling the learner as belonging exclusively to one

category. The combined effect of perceptual modalities (visualization, written word, listening, and activity) was not measured and may account for higher academic achievement scores.

Perceptual Modality

Null Hypothesis Three results found a significant difference between sex and visualization mean scores. Males scores significantly higher in visualization responses. Reinert (1976) did not find this. His findings found the significance in the kinesthetic (activity) area where females scored significantly higher than males. In this study, females did have a higher activity mean score than males but it was not significant.

That males scored significantly higher in visualization responses is consistent with recent brain research. Restak (1979) cites evidence that the sexes differ in their approaches to gaining knowledge about the world. Males tend to show early superiority in visualization, females in auditory capacities.

One implication is that the use of visual materials in the curriculum is important for males; that the traditional patterns of education that concentrate almost exclusively on the auditory modality is outdated. However, another implication may lie in hemisphericity.

The right brain is believed to be associated with the process-

ing of images, music, faces, and other nonverbal input; the left brain appears to deal in numbers, words, and analytical thought (Reynolds and Torrance, 1978; Raina, 1979; Restak, 1979; Dunn, Cavanaugh, Emerle, and Zenhausern, 1982). According to the theory of hemisphericity, right-preferenced individuals would tend to think in pictures; left-preferenced individuals in words. Brain researchers are not in agreement as to whether the ability of males to perform better than females on spatial tasks (use of visualization and hence the use of the right hemisphere) denotes structural or functional differences in the abilities of the sexes.

Although the original intent of the ELSIE was to provide information on perceptual modalities, the counselor can obtain a crude assessment of hemispheric preference. The perceptual modalities of visualization and activity are associated with the right hemisphere; listening and written word are associated with the left hemisphere.

The broader implication of perceptual modality studies, including this study, is not to offer visual materials to males because it is their strength; nor to categorize students according to dominant hemisphere, but to promote, through the proper selection of teaching strategies and curriculum materials, the development of both hemispheres and hence the strengthening of all perceptual modalities.

Temporality

Null Hypothesis One, Two, and Four dealt with temporality in regards to perceptual modality and the demographic characteristics of sex and grade level. These hypotheses were formed to determine if significant differences between perceptual modality scores for and within the three temporal groups would be found in order to provide additional trends in perceptual modalities based on temporality. No such significances were found. That of the five dependent variables identified in this study, temporal pace accounted for the greater influence on academic achievement. However, this influence or significance was not meaningful due to the negligible Multiple Square Correlation Coefficient value.

Null Hypothesis Two dealt with the sex and grade level in relationship to temporal group. It was noted in Chapter IV that this sample did not approximate the normal distribution postulated by Barsch (1974). By far, more students fell within the fast temporal group. Two questions emerge from this finding.

If the preferred temporal pace is a relatively constant state that is normally distributed as Barsch (1974) proposed, then was the sample group in this study typical?

Or, if the sample group was typical of the middle school population, then there seems to be a definite break between sixth and seventh grade regarding temporal pace. Sixth graders had more

individuals in the slow temporal group than either the seventh or eighth graders. Could it be that developmentally sixth graders are still in the brain growth spurt, and seventh and eighth graders are in plateau periods as hypothesized by Epstein and Toepher (McDaniel, 1982)? Could brain growth have an influence on the individual's style in relating to time?

Whatever the reasons for more fast-paced students in this study, the implication is that these individuals in the classroom will want things to move right along. Slow-paced presentations and activities will increase the likelihood that these individuals will become restless and/or bored. The teacher who is familiar with the concepts of temporality will know when to push the class, when to wait, and how to vary the instructional pace.

Recommendations for Further Study

Grade rather than age was selected as a variable in this study because the researcher believed grade placement was a better measure of the combined influences of school than was age. However, by such discrete categories, continuous data was lost. Replication of this study using actual age rather than grade placement is suggested.

The Edmonds Learning Style Identification Exercise was selected for this study because it provided a profile of perceptual modalities. However, to determine the impact of temporality on a desig-

nated perceptual modality, a different instrument should be used. The Swassing-Barbe Modality Index gives such discrete classifications. It is suggested that such a study be conducted. A consideration in using the Swassing-Barbe Modality Index is that the instrument requires training, is expensive, and must be administered individually.

The third recommendation deals exclusively with temporality. Is an individual's preferred temporal pace as consistent as Barsch (1974) stipulates, or as the child develops or matures, does his/her temporal pace also fluctuate? A recommendation for future research on temporality would entail a cross-sequential study involving various aged subjects over time.

Summary

The main objective of this study was to explore the possible relationship among perceptual modality, temporality, and academic achievement. The three significant findings of this study were: 1) a significant difference existed between grade level (6, 7, 8) and temporal pace. There were more individuals in the slow temporal group in the sixth grade than in the seventh or eighth grade; 2) the number of individuals in the three temporal groups were not normally distributed. The fast temporal group had more individuals than either the slow or medium groups combined; 3) there was a

significant difference between sex and visualization mean scores. Males scored significantly higher in visualization responses.

The implications for the academic counseling of middle school students based on the above findings were: 1) the use of visual materials in the curriculum is important for males; 2) individual temporal paces varied across grade level (6, 7, 8) with predominantly more individuals in the fast temporal group. The pacing of instruction should be varied to accomodate differences in students' temporal paces.

Regarding temporality, several questions arose during the study that need further attention. Are temporal paces in a given population normally distributed? And, is temporal pace relatively consistent over time? Further study is recommended.

BIBLIOGRAPHY

Andrews, J. D. Teaching Format and Students Style: Their Interactive Effects on Learning. Research in Higher Education, 1981, 14, pp. 161-178.

Ballinger, V., and Ballinger, R. Steps in Managing the Diagnostic-Prescriptive Process in the Foreign Language Classroom. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 33-37.

Bandler, R., and Grinder, J. The Structure of Magic I. Palo Alto, California: Science and Behavior Books, Inc., 1975.

Barbe, W. B., and Milone, Jr., M. N. What We Know About Modality Strengths. Educational Leadership, February 1981, 38(5), pp. 378-380.

_____. Teaching Through Modality Strengths: Look Before You Leap. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 54-57.

Barbe, W. B., Swassing, R. H., and Milone Jr., M. N. Teaching Through Modality Strengths: Concepts and Practices. Columbus, Ohio: Zaner-Bloser, Inc., 1979.

Barsch, R. H. Achieving Perceptual-Motor Efficiency: A Space-Oriented Approach to Learning. Seattle, Washington: Special Child Publications, 1968.

_____. Each to a Different Drummer. Canoga Park, California: The Ray Barsch Center for Learning, 1974.

Begley, S., Carey, J., and Sawhill, R. How the Brain Works. Newsweek, February 7, 1983, pp. 40-47.

Bernstein, B. E. Tailoring Teaching to Learning Styles. Independent School Bulletin, December 1974, 34, pp. 50-52.

Blakeslee, T. R. Brain Behavior Research. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 185-191.

Bloom, B. S. in Harvey, K., and Horton, L. Bloom's Human Characteristics and School Learning. Phi Delta Kappan, November 1977, pp. 189-193.

Bruno, A. Learning Activities for Tactual Learners. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 25-27.

Buros, O. K. (Ed.) The Eighth Mental Measurements Yearbook, Volume I. Highland Park, New Jersey: The Grypon Press, 1978, pp. 52-58.

Butler, K. A. Learning Style Across Content Areas. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 61-67.

Button, C. Teaching for Individual Differences: A Necessary Interaction. Educational Leadership, March 1977, pp. 435-438.

Cafferty, E. An Analysis of Student Performance Based Upon the Degree of Match Between the Educational Cognitive Style of the Teacher and the Educational Cognitive Style of the Students. Unpublished doctoral dissertation, University of Nebraska, 1980.

Carbo, M. A. An Analysis of the Relationships Between the Modality Preferences of Kindergartners and Selected Reading Treatments as They Affect the Learning of a Basic Sight-Word Vocabulary. Unpublished doctoral dissertation, St. John's University, 1980.

Cavanaugh, D. P. Student Learning Styles: A Diagnostic-Prescriptive Approach to Instruction. Phi Delta Kappan, November 1981, 63(3), pp. 202-203.

Copenhaver, R. W. The Consistency of Student Learning Styles as Students Move from English to Mathematics. Unpublished doctoral dissertation, Indiana University, 1979.

Cornbleth, C. Curriculum Materials Can Make A Difference. Educational Leadership, April 1981, 38(7), pp. 567-568.

Cott, A. The Metronome as a Measuring Device in the Study of Disorders of 'Time Flow' in Schizophrenia. Schizopherenia, 1969, 1(3), pp. 148-160.

Courtney, E. W. Analysis. Corvallis, Oregon: Oregon State University Division of Continuing Education Publications, 1982.

Davidman, L. Learning Style: The Myth, the Panacea, the Wisdom. Phi Delta Kappan, May 1981, 62(9), pp. 641-645.

Domino, G. Interactive Effects of Achievement Orientation and Teaching Styles on Academic Achievement. ACT Research Report, 1970, 39, pp. 1-9.

Douglass, C. B. Making Biology Easier to Understand. American Biology Teacher, May 1979, 41(5), pp. 277-281.

Dunn, R. S. Teaching in a Purple Fog: What We Don't Know About Learning Style. National Association of Secondary School Principals Bulletin, March 1981, 65(443), pp. 33-36.

Dunn, R., Cavanaugh, D. P., Emerle, B. M., and Zenhausern, R. Hemispheric Preferences: The Newest Element of Learning Style. American Biology Teacher, May 1982, 44(5), pp. 291-294.

Dunn, R., and Dunn, K. Finding the Best Fit: Learning Styles, Teaching Styles. National Association of Secondary School Principals Bulletin, October 1975, 59, pp. 37-49.

_____. How to Diagnose Learning Styles. Instructor, September 1977, 87(2), pp. 122-144.

_____. Teaching Students Through Their Individual Learning Styles: A Practical Approach. Reston, Virginia: Reston Publishing Company, Inc., 1978.

Dunn, R., Dunn, K., and Price, G. Diagnosing Learning Styles: A Prescription for Avoiding Malpractice Suits. Phi Delta Kappan, January 1977, pp. 418-420.

_____. Identifying Individual Learning Styles. In Student Learning Styles: Diagnosing and Prescribing Programs. Reston, Virginia: National Association of Secondary School Principals, 1979, pp. 39-54.

Farr, B. J. Individual Differences In Learning: Predicting One's More Effective Learning Modality. Unpublished doctoral dissertation, Catholic University of America, 1971.

Gearheart, B. R. Learning Disabilities: Educational Strategies (3rd edition). St. Louis: The C. V. Mosby Company, 1981.

Gregorc, A. F. Learning/Teaching Styles: Potent Forces Behind Them. Educational Leadership, January 1979, 36(4), pp. 234-236.

_____. Learning/Teaching Styles: Their Nature and Effects. In Student Learning Styles: Diagnosing and Prescribing Programs. Reston, Virginia: National Association of Secondary School Principals, 1979, pp. 19-26.

_____. Learning Style/Brain Research: Harbinger of An Emerging Psychology. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 3-10.

Gregorc, A. F., and Ward, H. A New Definition for Individual. National Association of Secondary School Principals Bulletin, February 1977, pp. 20-26.

Griggs, S. Counseling Middle School Students for Their Individual Learning Styles. In Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 19-24.

Griggs, S. A., and Price, G. E. Self-Concept Relates to Learning Style in the Junior High. Phi Delta Kappan, April 1981, 62(8), p. 604.

Grinder, J., and Bandler, R. The Structure of Magic II. Palo Alto, California: Science and Behavior Books, Inc., 1976.

Gorsuch, R. L. Factor Analysis. Philadelphia: W. B. Saunders Company, 1974.

Hankins, G. Motivation and Individual Learning Styles. Engineering Education, March 1974, 64(6), pp. 408-411.

Harman, R. L., and O'Neill, C. Neuro Linguistic Programming for Counselors. The Personnel and Guidance Journal, 1981, 59, pp. 449-453.

Harvey, K., and Horton, L. Bloom's Human Characteristics and School Learning. Phi Delta Kappan, November 1977, pp. 189-193.

Hodges, H. Madison Prep: Alternatives Through Learning Styles. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 28-32.

Hull, C., and Nie, N. (eds) SPSS Update 7-9: New Procedures and Facilities for Releases No. 7-9. New York: McGraw-Hill Book Company, 1981.

Hunt, D. Learning Style and the Interdependence of Practice and Theory. Phi Delta Kappan, May 1981, 62(9), p. 647.

_____. Learning Style and Student Needs: An Introduction to Conceptual Level. In Student Learning Styles: Diagnosing and Prescribing Programs. Reston, Virginia: National Association of Secondary School Principals, 1979, pp. 27-38.

Keefe, J. W. Assessing Student Learning Styles: An Overview. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 43-53.

Krimsky, J. S. A Comparative Study of the Effects of Matching and Mismatching Fourth Grade Students With Their Learning Style Preferences for the Environmental Element of Light and Their Subsequent Reading Speed and Accuracy Scores. Unpublished doctoral dissertation, St. John's University, 1982.

Kuntz, S., and Letteri, C. A. Cognitive Profiles of Mothers: Causal Factors in Determining Child's Profile. Contemporary Education, October 1981, pp. 26-30.

Kusler, G. Getting to Know You. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 11-14.

Letteri, C. A. Cognitive Profile: Relationship to Achievement and Development. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 68-72.

Levy, J. Children Think with Whole Brains: Myth and Reality. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 173-184.

Lynch, P. K. An Analysis of the Relationship Among Academic Achievement, Attendance, and the Individual Learning Style Time Preferences of Eleventh and Twelfth Grade Students Identified as Initial or Chronic Truants in a Suburban New York School District. Unpublished doctoral dissertation, St. John's University, 1981.

Marcus, L. How Teachers View Student Learning Styles. National Association of Secondary School Principals Bulletin, April 1977, 61, pp. 112-114.

_____. Learning Style and Ability Grouping Among Seventh Grade Students. The Clearing House, April 1979, 8(52), pp. 377-380.

Martin, M. K. Effects of the Interaction Between Students' Learning Styles and High School Instructional Environments. Unpublished doctoral dissertation, University of Oregon, 1977.

McDaniel, T. R. What's Your P. Q. (Principalship Quotient)? A Quiz on Improving Instruction. Phi Delta Kappan, March 1982, 63(7), pp. 464-468.

Neter, J., and Wasserman, W. Applied Linear Statistical Models: Regression, Analysis of Variance, and Experimental Designs, Homewood, Illinois: Richard D. Irwin, Inc., 1974.

Pizzo, J. An Investigation of the Relationships Between Selected Acoustic Environments and Sound, an Element of Learning Style, as They Affect Sixth Grade Students' Reading Achievement and Attitudes. Unpublished doctoral dissertation, St. John's University, 1981.

Price, G. Summary of Research on Learning Styles Based on the Learning Style Inventory. Paper presented at the Annual Meeting of the American Educational Research Association, New York, New York, April 4-8, 1977.

Raina, M. Education of the Left and the Right. International Review of Education, 1979, 25(1), pp. 7-20.

Raywid, M. A. Models of the Teaching/Learning Situation. Phi Delta Kappan, April 1977, pp. 631-635.

Reilly, D. H. Auditory/Visual Integration, Sex, and Reading Achievement. Journal of Educational Psychology, 1971, 62(6), pp. 482-486.

Reinert, H. One Picture Is Worth a Thousand Words? Not Necessarily! The Modern Language Journal, April 1976, 60(4), pp. 160-168.

_____. Unpublished personal papers, Edmonds, Washington, 1982.

_____. Unpublished personal papers, Edmonds, Washington, 1983.

Restak, R. The Brain: The Last Frontier. New York, New York: Warner Books, Inc., 1979.

Reynolds, C. R., and Torrance, E. P. Perceived Changes in Styles of Learning and Thinking (Hermisphericity) Through Direct and Indirect Training. Journal of Creative Behavior, 1978, 12(4), pp. 247-252.

Ribich, W., and Schmeck, R. R. Multivariate Relationships Between Measures of Learning Style and Memory. Journal of Research in Personality, 1979, 13, pp. 515-529.

Schmeck, R. R. Inventory of Learning Process. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 73-80.

Shea, T. C. An Investigation of the Relationship(s) Among Preferences for the Learning Style Element of Design, Selected Instructional Environments, and Reading Test Achievement of Ninth Grade Students to Improve Administrative Determinations Concerning Effective Educational Facilities. Unpublished doctoral dissertation, St. John's University, 1983.

Soares, L. M., and Soares, A. T. Brain Research: Implications for Learning. Paper presented at the Congress of Applied Psychology, Edinburgh, Scotland, July 1982.

Sperry, L. Counselors and Learning Styles. Personnel and Guidance Journal, March 1973, pp. 478-483.

Staley, F. A. Hemispheric Brain Research: A Breakthrough in Outdoor Education. Journal of Physical Education and Recreation, April 1980, 51(4), pp. 28-30, 63-64.

Stronck, D. R. The Educational Implications of Human Individuality. American Bilogy Teacher, March 1980, 42(3), pp. 146-151.

Talmadge, G. K., and Shearer, J. W. Relationships Among Learning Styles, Instructional Methods, and the Nature of Learning Experiences. Journal of Educational Psychology, 1969, 60(3), pp. 222-230.

Tannenbaum, R. K. An Investigation of the Relationship(s) Between Selected Instructional Techniques and Identified Field Dependent and Field Independent Cognitive Styles as Evidence Among High School Students Enrolled in Studies of Nutrition. Unpublished doctoral dissertation, St. John's University, 1982.

Trautman, P. An Investigation of the Relationships Between Selected Instructional Techniques and Identified Cognitive Style. Unpublished doctoral dissertation, St. John's University, 1979.

Vigna, R. A., and Martin, M. K. Learning Styles at Bishop Carrol High School. In Student Learning Styles and Brain Behavior. Reston, Virginia: National Association of Secondary School Principals, 1982, pp. 38-42.

Welkowitz, J., Ewen, R. B., and Cohen, J. Introductory Statistics for the Behavioral Sciences. New York: Academic Press, 1976.

APPENDICES

APPENDIX A

Letter to Parents

Dear Parents(s):

I need your help. I am involved in a graduate study project on Learning Styles, that is, understanding how students learn. To gather this information, I need students' participation in this project. I have selected the sixth, seventh, and eighth grades to be part of the study.

During the next few weeks, I will be visiting your child's classroom. Your child will be given the Edmonds Learning Style Identification Exercise. It is an exercise that tells how a student best takes in information, that is, seeing, reading, hearing, or doing. This exercise takes about twenty minutes. Next, I will use a metronome (exactly like musicians use to measure music tempo) to help the students determine the beat or rate at which they feel the most comfortable. This is called Temporality. There is a precaution in regards to the use of the metronome with some students. Those who are hearing impaired and/or susceptible to seizures should not do metronome pacing. It seems that the higher rates bother these students.

All information will be kept confidential. Your child will not be identified by name in the results. I would, though, be happy to share your child's results with you. If you have any questions regarding these two exercises, please contact me. If you do not wish your child to participate in the study, either contact me at 447-6283, or write a note to the homeroom teacher (for sixth graders) or to the English teacher (for seventh and eighth graders). I am hoping this research will help Junior High educators to better understand Student Learning Styles and Temporality. Thank you for helping me with my graduate study project.

Sincerely,

Kathleen Zachow
Counselor

KZ/cw

Appendix B

ELSIE Answer Sheet

LEARNING STYLE IDENTIFICATION EXERCISE (ELSIE)

Name _____ Date _____

(Circle correct sex and grade) Sex: Boy Girl Grade 6 7 8 Age: ____

Instructions: As each word is read, circle the letter indicating your response according to the following symbols:

P = See a picture of some object or activity in your mind.

W = See the word spelled out in your mind.

H = No picture in your mind; just hear the word.

F = Have a physical or emotional feeling about the word.

Remember to circle the first thing that happens to you as you hear each word. Never circle more than one letter for each word.

Practice Exercises:

1. p w h f	2. w h f p	3. h f p w	4. f p w h

---

1. p w h f	2. w h f p	3. h f p w	4. f p w h
5. f h w p	6. p f h w	7. w p f h	8. h w p f
9. p w h f	10. w h f p	11. h f p w	12. f p w h
13. f h w p	14. p f h w	15. w p f h	16. h w p f
17. p w h f	18. w h f p	19. h f p w	20. f p w h
21. f h w p	22. p f h w	23. w p f h	24. h w p f
25. p w h f	26. w h f p	27. h f p w	28. f p w h
29. f h w p	30. p f h w	31. w p f h	32. h w p f
33. p w h f	34. w h f p	35. h f p w	36. f p w h
37. f h w p	38. p f h w	39. w p f h	40. h w p f
41. p w h f	42. w h f p	43. h f p w	44. f p w h
45. f h w p	46. p f h w	47. w p f h	48. h w p f
49. p w h f	50. w h f p		

Appendix C

ELSIE Profile Sheet

ELSIE Profile Sheet*

BAND	VISUALIZATION P responses	WRITTEN WORD W responses	LISTENING H responses	ACTIVITY F responses
+4	38	20	22	26
+3	34	17	17	20
+2	29	15	15	16
+1	19	13	13	12
0	17	11	11	10
0	12	9	9	6
-1	7	7	7	3
-2	4	5	5	2
-3	2	3	3	1
4				

BANDS: P____ W____ H____ F____ TEMPORAL RATE_____

*Adapted from the Edmonds School District No. 15 ELSIE Profile Sheet.

Appendix D

Temporal Pacing Exercise

TEMPORAL PACING EXERCISE

Answer Sheet

Name _____ Date _____

(Circle correct sex and grade) Sex: Boy Girl Grade: 6 7 8 Age: _____

Instructions: Each beat will be played for twenty (20) seconds. While the beat is going, draw a square, one line for each beat. So for every four beats, you will have a square on your paper.

When you find a beat that is "just right" for you, mark it some way. Examples: *, X, Yes, No, Great!

Practice Exercise:

Beat A:

Reaction: OK

****

Do not mark in this space until you have completed the exercise.

Beats I liked the best:

1. The beat I liked the best is Number _____.
2. The beat I liked second best is Number _____.
3. My third choice is beat Number _____.

****

Beat 1.

Reaction: _____

Beat 2.

Reaction: _____

Beat 3.

Reaction: _____

Beat 4.

Reaction: _____

Beat 5.

Reaction: _____

Beat 6.

Reaction: _____

Beat 7.

Reaction: _____

Beat 8.

Reaction: _____

Beat 9.

Reaction: _____

Beat 10.

Reaction: _____

Beat 11.

Reaction: _____

Beat 12.

Reaction: _____

Beat 13.

Reaction: _____

Beat 14.

Reaction: _____

Beat 15.

Reaction: _____

Beat 16.

Reaction: _____

Beat 17.

Reaction: _____

Beat 18.

Reaction: _____

Beat 19.

Reaction: _____

Beat 20.

Reaction: _____

Beat 21.

Reaction: _____

Now, go back over your answer sheet. Find the three beats you liked the best. On the first page in the section, "Beats I Like the Best," list, in order, your top three choices.