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An assessment of the relationship between teacher teaching style and student learning style with relation to academic achievement and absenteeism of seniors in a rural high school in north central Massachusetts.

Carol May Grout

University of Massachusetts Amherst

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AN ASSESSMENT OF THE RELATIONSHIP BETWEEN TEACHER TEACHING STYLE AND STUDENT LEARNING STYLE WITH RELATION TO ACADEMIC ACHIEVEMENT AND ABSENTEEISM OF SENIORS IN A RURAL HIGH SCHOOL IN NORTH CENTRAL MASSACHUSETTS

A Dissertation Presented
by
CORAL MAY GROUT

Submitted to the Graduate School of the University of Massachusetts in partial fulfillment of the requirements for the degree of
DOCTOR OF EDUCATION
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School of Education
AN ASSESSMENT OF THE RELATIONSHIP BETWEEN TEACHER TEACHING STYLE AND STUDENT LEARNING STYLE WITH RELATION TO ACADEMIC ACHIEVEMENT AND ABSENTEEISM OF SENIORS IN A RURAL HIGH SCHOOL IN NORTH CENTRAL MASSACHUSETTS

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DEDICATION

To Dad, Mom and Gram
ACKNOWLEDGEMENTS

Throughout my tenure at the University of Massachusetts I have been extremely fortunate to have the strong support of various individuals, as I worked toward my degree. I would like to express my sincere thanks to the people who have been a part of my doctoral program.

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ABSTRACT

AN ASSESSMENT OF THE RELATIONSHIP BETWEEN TEACHER TEACHING STYLE AND STUDENT LEARNING STYLE WITH RELATION TO ACADEMIC ACHIEVEMENT AND ABSENTEEISM OF SENIORS IN A RURAL HIGH SCHOOL IN NORTH CENTRAL MASSACHUSETTS

MAY, 1990

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The purpose of the study was to examine the relationships between attendance and academic achievement of grade twelve students and compatibility of teacher and student learning style. The study also investigated the ability of senior English teachers to predict the learning styles of the students assigned to them. Other areas of study included: (1) the relationship between the length of acquaintance of the teacher with the student and his/her ability to predict the student's learning style; (2) the relationship between sex of the student and achievement; and (3) the predominance of students favoring English (including grammar, literature and composition) class and the compatibility of teacher/student learning styles.
Ninety-nine (99) grade twelve students and four (4) senior English teachers participated in the study. Each subject completed the Gregorc Style Delineator.

The results indicated that: (1) a significant relationship existed between those students whose learning style matched the teaching style of their English teachers and the degree to which the students enjoyed English; (2) there was a significant relationship between the learning/teaching style of students/teachers and the students' attendance patterns; (3) the correlation between the sex of the student and his/her academic achievement was significant; (4) teachers in the study predicted the individual learning styles with low accuracy; (5) a significant relationship existed when comparing the learning styles of students who were compatible with the teaching styles of their English teachers and English achievement; and (6) the relationship between the length of acquaintance of the teacher with the student and his/her ability to predict learning styles was not significant. All questions examined in the study were analyzed at a significance of 0.05.

It was concluded that the matching of teacher and student learning styles did significantly improve attendance and academic achievement. Teachers were able to identify the learning styles of their students. The sex of the student had an effect on academic achievement. Students who liked English class had a compatible learning style with
their teachers. Length of acquaintance had little effect on a teacher's ability to predict student learning style.
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Individual differences in our population have served as a challenging teaching dilemma for educators for many centuries. Issues have centered around finding ways to describe the learning process. The effects of the mismatching or matching of teacher learning style with student learning style have only begun scratching the surface of the educational research community. Researchers have examined not only the brain and how it processes information (Sperry, 1980; Richert, 1987; Zenhausern, 1982), but also the differences between theories promoted through research and the educational practices of teachers in their classrooms (Cantor, 1946). While individual differences have been recognized, theorized, and examined by members of the educational profession, it is agreed that although much has been attempted by the educational community, such as homogenous grouping and the PLATO system for individual learners, little practical response to learning styles theory has taken place within the schools of our country.

Only recently have schools in such cities and towns as Chicago and St. Louis Park, MN begun adapting learning styles test results to individual schools and classrooms. Many feel that the failure of schools to accommodate individual differences is in part the reason for the poor rating of our schools today (Dunn, 1979; Gregorc, 1984).
Though still somewhat dormant, the concept of learning styles or individual learning differences has been revitalized during the past twenty years. The results of the work of researchers (Dunn and Dunn, 1989; Gregorc, 1988; McCarthy, 1989) have begun to be included in administrative discussions, classrooms activities, and school curricula.

Henry David Thoreau, on the cover of an Association for Supervision and Curriculum Development publication (1985), tells us that, "If a man does not keep pace with his companions, perhaps it is because he hears a different drummer. Let him step to the music which he hears, however measured or far away." Sylvia Fair (1982) describes the substance of learning styles in The Bedspread. This is a short story of two elderly sisters whose later lives are spent totally bedridden. The two sisters decide to decorate their bedspread. The two measure the spread and place a mark to separate it into two halves. They begin sewing and producing a replica of their house. While one sister sews neatly and evenly, the other does not. Each sister's house grows steadily. When each is finished, the spread is turned so that each sister can see the other's work. Each house appears different. While one side is neat, with everything in its place, the other is not. Each sister tells the other about the nice job she has done. The messy side, according to one sister, is happy. The neat one looks nice, but lacks the happiness of the other side. The two sisters eventually pass away and their bedspread becomes...
the property of a museum for all to see. The bedspread is turned every other day, so that children can see that, although each side is different, it is equally good and important.

While The Bedspread reinforces the importance of the positivity of student differences, schools tend to restrict individuality in learning (Guild and Garger, 1985; Mackenzie, 1983). A review of the reports recently published by prominent individuals and commissions (Education Week, 1988), suggests the nation's schools are not effectively meeting needs of students. Rules and decisions are made which are to be interpreted by all students and administrators in the same way. Programs and basal readers are written for all students to understand in the same way. Teachers provide lessons and assignments for the entire classes, paying little attention to individualization. Solutions to these major educational problems of matching teacher with student style involve much more than discussion or simple practice alterations.

Guild and Garger (1985) suggest that, "Theories of style have the power for changing the status quo by focusing educational decisions on the individual person." Research focused upon student learning style may confirm some or much of the theory related to student learning style eventually, and contribute to a better educational experience for future generations of children and youth. Since the early 1960's, increasing numbers of educational re-
searchers have recognized two areas of concern. The areas involve the importance of individuality and how students and adults take in, process, and produce information (Witkin, 1976; Dunn, 1972; Gregorc, 1981; Berthelot, 1982; Barbe and Milone, 1981; Carbo, 1982; Butler, 1984; Dunn and Dunn, 1975; Tyler, 1965). Tyler (1965) summarizes this awareness as follows:

Therefore in both education and psychology, the possibility that the world might actually look, sound, and feel differently to different persons, that they might solve problems and form concepts in quite different ways, and that the same stimulating situation might carry different meanings for them was something investigators did not generally take into account (p. 211).

Awareness of individual differences in learning styles by increasing numbers of educators has stimulated much of the recent research with learning styles. Outcomes of the research are being shared through a variety of publications (e.g. Educational Leadership, Learning, Instructor). Members of the educational community have been told that student learning styles can now be identified with a reasonable degree of accuracy and that this knowledge has definite implications for the classroom (Dunn, 1989; DeBello, 1988).

A number of learning styles inventories have been developed within the past twenty years, including the LSI (Dunn and Dunn, 1978), Delineator (Gregorc, 1977), 4MAT (McCarthy, 1980), LSIS (Malcom et al, 1981), Child Rating Form (Ramirez and Castaneda, 1974), Learning Styles Inven-
tory (Canfield and Lafferty, 1976), and the Learning Style Inventory (Kolb, 1977). Numerous other inventories also exist and they will be recognized in Chapter II. The development of assessment instruments contributed significantly toward an understanding and recognition of individuals' learning style differences.

Although researchers have examined learning style identification and methods of accommodating classrooms and materials to meet individual needs, classroom teachers have not utilized the information to the extent suggested by the results of the research. Dunn and Dunn (1975) explain that "educators were either not aware of the cognitive style research or ignored it, partly because many of the studies were conducted in fields other than education, and partly because educators ... have emphasized PROGRAMS rather than INDIVIDUAL learning styles" (p. 13).

As far back as 1946, Cantor (1946) believed that "there are individual differences in learning which have been recognized as theory as often as they have been denied in practice" (p. 185). Barth, a principal, explains that, "I have found it possible to transform differences among children, teachers, parents, and administrators into powerful educational assets." (p. ix, 1985). Recent publications by the Learning Styles Network and Learning Magazine also promote the assertion that a learning styles approach to education is commencing to make an entrance into the public school domain.
Given the number of learning styles instruments presently being marketed, two quandaries arise: do all instruments measure the same process, learning style; and if so, which one should the classroom teacher select? Correlations between the Myers-Briggs Type Indicator (MBTI) and LSI (Dunn) have been attempted and reported in the Learning Styles Network Newsletter (1987). In the study, students were assessed using both instruments. No significant correlation was determined. The Dunns concluded that the LSI and MBTI could not be employed interchangeably to determine student learning styles. Teachers may select from an array of assessment instruments designed for particular grade/age levels. While the Gregorc Delineator has been designed for use with young adults, the Kolb Learning Style Inventory may be used with the same group of students. Some assessments measure cognitive style, others measure affective style, and yet others are considered multidimensional. Thus, the identification of student learning styles continues to be a major educational problem.

Evidence accumulated indicates that students learn best when taught through their preferred modality or style (Dunn and Dunn, 1981, 1987, 1988; Gregorc, 1979; Price, 1982; Hill, 1971; DeBello, 1989; French, 1977; Butler, 1982; McCarthy, 1989). Barbe and Swassing (1979) note that we teach as we learn best, not as we were taught. [Teachers] tend to project their own modality strengths into the selection of materials, teaching strategies and procedures, and methods of reinforcement. (p. 66)
It would appear, then, that matching of teacher style with student style would increase the probability of better academic achievement. Similarly, such a match may decrease the probability of student truancy, illness, or other form of absence, in addition to behavioral problems. One noteworthy study by Dunn (1981) did, in fact, determine that the matching of teacher and student learning styles was a viable alternative to the average teaching approach in today's classrooms. Yet, although Dunn's proposal holds promise, only a few studies provide support to date (Hill, 1981; Gregorc, 1982; Witkin, 1973; Pittman, 1983; Cafferty, 1980; Shea, 1983; Murrain, 1983). Dunn, Dunn, and Price (1977) noted, also, that

Repeatedly our data revealed that, when taught through methods that complimented their learning characteristics, students at all levels became increasingly motivated and achieved better academically. (p. 230)

While Cronbach (1967) and Kolb (1981) warn educators about the danger of misusing learning styles information, their admonishment appears to be a minority viewpoint.

Even though extensive research has been conducted on learning styles during the past twenty years, doubt continues to persist among educators regarding their ability to apply the results to increase academic performance, good behavior and attendance. Researchers continue to build upon each others findings (e.g. Keefe et al, NASSP) and have improved upon their own research (e.g. Gregorc, 1985). Continued research into learning style identification as a
means of increasing academic achievement and decreasing behav¬
ioral dissention/absenteeism within classrooms is needed.

The present study addresses the problem of relationships be¬
tween teacher/student learning style and school attendance and academic success in selected English classes. The Gregorc Delineator has been applied within this context in an attempt to establish such relationships. No such relationships have been reported by Gregorc to date, although the Dunns - using the LSI - suggest a positive relationship can be discerned (1986). Hence, the study explores the po¬
tential of Gregorc's Delineator to ascertain relationships between learning style and school effects.

Purpose

The purpose of the study is to examine the relationship between student learning style data and selected student school performance data. The examination focuses upon four (4) relationships:

---matches in the learning style of students/teachers and students' academic performance,
---matches in the learning style of student/teacher and student's school attendance policy,
---English teachers' capacity to predict the learning styles of students enrolled in their classes, and
---student sex and cognitive style on the one hand and student mediation traits (perception and ordering) on the
other (within different ability grouped twelfth grade classes).

Significance

Research into the relationship between (a) student achievement and school attendance and (b) teaching style and student learning style, while expanding, is still in a primitive state. One line of research, pursued by Gregorc and his colleagues (1984), is probed by the researcher. Gregorc's work could provide specifics on learning styles to teachers and students in the form of a useful, short instrument. The instrument would provide teachers with more information to use in teaching in order to provide students with materials applicable to their particular learning styles. While research by the Dunns has promoted acceptance of learning styles in classrooms across the United States, their instrument is somewhat lengthy. Although Butler (1985) has applied the results of the Gregorc Delin- eator to a few classrooms, significant data collected through the present study could enhance further classroom adaptation, using a less time-consuming and expensive instrument.

The study provides additional information for existing knowledge on learning styles in a number of ways. First, it was employed with students on the grade 12 level in a public, rural high school. While one other study employed
the Gregorc instrument with grade 12 students, the study sample was drawn within a vocational school. Secondly, the same instrument was administered in order to compare teacher and student learning style. A most significant aspect involved the examination of school attendance and its relationship with matched/mismatched student and teacher style. No approach of this type was found in any study involving the Gregorc Delineator, although one study of the Dunn instrument determined that matched teacher and student styles affected attendance. Finally, and perhaps most importantly, the study examined the ability of Narragansett Regional High School English teachers to identify the learning styles of their students, which could be considered a necessary skill in providing the best educational materials and lessons to students in the future.

Relevant Terms

LEARNING STYLE: Learning styles are, according to Gregorc, "behaviors, characteristics, and mannerisms which are symptoms of mental qualities used for gathering data from the environment" (p. 179). Dunn (p. 12) provides a similar definition in that learning style is "the way in which each person absorbs and retains information and/or skills, regardless of how that process is described, it is drastically different for each person."
COGNITIVE STYLE: This term has often been used interchangeably with the term, "learning style". Kogan (1972) defines it as "individual variations in modes of perceiving, remembering and thinking or as distinctive ways of apprehending, storing, transforming the utilizing information." While there is a relationship between the two, cognitive style is considered to be bipolar, consisting of two sides, as scanning versus focusing or leveling versus sharpening.

MEDIATION ABILITIES: These are the mental forces used by an individual to take in information and send data back into the environment. These are the dualities in cognitive style, e.g. CS, AS, AR, and CR (using Gregorc's terms) or field dependent/field independent (using Witkin's terms).

PHENOMENOLOGY: This word consists of three parts --- "pheno", "noumena", and "logos". "Pheno" refers to one's outward behaviors; "noumena" to those invisible forces which drive an individual; and "logos" refers to the nature or root of something. In other words, "phenomenology" refers to the inward driving forces which are behind an individual's outer behavior.

PERCEPTION: This is the means through which an individual grasps information, which is defined by Gregorc as abstract or concrete.
ORDERING: This refers to the way the mind arranges information through sequencing or randomness.

DOMINANT STYLE TRAITS: This is a term employed by Gregorc to identify the four dominant styles associated with his instrumentation: Concrete sequential, Abstract sequential, Concrete random, and Abstract random.

CONCRETE SEQUENTIAL: The person associated with this particular style perceives the world as concrete, objective, and physical and maintains a linear ordering process. Other identifications include, among others, a lack of creativity, desire to own valuable objects, efficiency, stability, and holders to tradition.

ABSTRACT SEQUENTIAL: The individual displaying this style perceives the real world as being abstract or metaphysical. His/her ordering process is not linear, but it is sequential. Several other characteristics include gathering knowledge for the sake of knowledge, a cold and aloof appearance, love of polysyllabic words, and absentmindedness.

CONCRETE RANDOM: The concrete random perceives the world as being real and physical and orders in a three-dimensional process. This person desires proof at all costs. He/she is also very intuitive, easily irritated by others who...
cannot draw the same conclusions as quickly as the CR, and is considered to be a curiosity seeker.

ABSTRACT RANDOM: This person's perception of the world is that it is a non-physical world of feelings. The ordering process is non-linear or random. Traits associated with this style are messiness, tardiness, and a love of plants.

Limitations

Generalizability of the study was constricted by a limited sample of students (99) and especially, faculty (4). Although the entire English faculty participated in the study, the school is extremely small, thus limiting the study. Curry (1987) cited validity and reliability of assessment instruments, but failed to include information regarding the Gregorc Delineator. The only information involving the Delineator has been cited by Gregorc, the author, in a publication accompanying the instrument. The publications cites statistics based upon one hundred ten subjects, slightly greater than the present study. Without additional studies by additional researchers, the validity and reliability remain somewhat questionable. Although advanced placement and above average seniors indicated an ability to understand the words employed in the Delineator, students in other classes had difficulty. To assist students in completion of the instrument, each received a syn-
onym listing of the words, thus hampering the results. The author of the Delineator has explained that the words used in the instrument have been selected in order to clean first impressions. Use of synonyms defeats the purpose by providing words with different connotations, which, in turn, may affect first impressions.
James Keefe, Director of Research for the National Association of Secondary School Principals, has written that:

Learning style diagnosis...gives the most powerful leverage yet available to educators to analyze, motivate, and assist students in school. It is the foundation of a truly modern approach to education. (1979, p. 132)

Since the publication of this article, learning styles researchers have delved deeply into this area of education. Most have reported almost unbelievable degrees of success, using a variety of learning styles-based instruments (Dunn, Dunn and Price, 1981; Gregorc, 1979; Mamchur, 1982; Macmurray, 1985).

The examination of Learning Style has mushroomed in the late 1970's and throughout the 1980's. Of particular interest is the fact that research involving learning styles has taken place at more than sixty (60) universities since 1979. Additionally, the same conclusion may be drawn from a review of the literature. ERIC (1989) includes thirteen thousand (13,000) listings under the topic of learning style, while only five years ago, the number was merely two thousand three hundred (2,300). Realizing that only a percentage of the information available through ERIC and other sources could be employed in this review and study, the literature review was confined to those studies
involved with secondary students, although additional studies on other academic levels were reviewed when applicable to employment of the Gregorc instrument.

This author has conducted a review of the literature throughout the past two and one-half years, which has included computer searches of Psychological Abstracts (1971-1986), ERIC (Educational Resources Information Center) (1970-1989), and Dissertation Abstracts International (1970-1988), plus she reviewed approximately two hundred seventy-five (275) articles, books, monographs, and speeches. The author also participated in several workshops with Rita Dunn, Kenneth Dunn, Anthony Gregorc, Bernice McCarthy, Thomas DeBello, and others through the Association for Supervision and Curriculum Development (ASCD) and the Massachusetts Department of Education.

Although the majority of learning styles research has been conducted during the past ten to twenty years, the concept dates as far back as Hippocrates, who was the first person to suggest that the brain was the mind's organ. In the more recent past, Carl Gustav Jung researched brain behavior in the 1920's, which served as a preliminary investigation into style. For the purpose of this review, however, the major emphasis of the research will be examined for the years 1970 through 1989.

This paper will cover (1) learning style theories which have been developed, and (2) specific learning and teaching style instruments.
Cognitive Style

Keefe, in *Student Learning Styles and Brain Behavior* (p. 227) has identified several student learning styles—cognitive, affective, and physiological. Brown and Cooper (1984) indicate that learning style consists of three categories, as well—cognitive, social, and expressive. For the purpose of this paper, only cognitive style will be addressed. Cognitive style, then, may be considered a different entity from learning style. Learning style includes those internal structures and processes which allow the person to perceive, interpret, and use information. Cognitive style, if one follows Brown and Cooper's understanding, refers to an individual's preferred mode of taking in information. Kogan also offered a definition of cognitive style in his 1971 article, "Educational Implications of Cognitive Style." He wrote:

Cognitive styles can be most directly defined as individual variations in modes of perceiving, remembering, and thinking or as distinctive ways of apprehending, storing, transforming, and utilizing information. It may be noted that abilities also involve the foregoing properties, but a difference should be noted. Abilities concern levels of skill—the more or less of performance—whereas cognitive styles give greater weight to the manner and form of cognition. (p. 25)

Basically, the major distinction between the terminology of learning styles and cognitive style lies in the number of elements considered by each category. Cognitive style is considered bipolar or dual (e.g. perception versus ordering, field dependent versus field independent). Kirby
(1979) noted that learning style consists of many elements which are not "either-or". According to Avery (1985), he provides an excellent summary of cognitive style dimensions. This table is reproduced on the following four pages.
### TABLE 1
Dimensions of cognitive style

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field dependent/independent</td>
<td>A global versus analytical way of perceiving. Entails the ability to perceive items without being influenced by the background.</td>
<td>Witkin et al. (1954); Witkin (1976)</td>
</tr>
<tr>
<td>Analytical/non-analytical conceptualizing</td>
<td>Analytical style entails differentiating attributes or qualities. Non-analytical style responses may be more relational or thematic.</td>
<td>Kagan et al. (1964); Messick and Kogan (1963)</td>
</tr>
<tr>
<td>Impulsivity/reflectiveness</td>
<td>Impulsivity is characterized by quick responses, reflectivity by more deliberate, slower responses. The impulsive person is quicker but makes more errors.</td>
<td>Kagan (1985)</td>
</tr>
<tr>
<td>Risk-taking/caution</td>
<td>Risk taking is characterized by taking risks even when the odds for success are poor. Caution is characterized by reluctance to take chances except when the probability of success is great.</td>
<td>Kogan and Wallach (1964)</td>
</tr>
<tr>
<td>Conceptual integration (integrative complexity)</td>
<td>Extent to which categories or dimensions of information are perceived to be integrated in multiple and different ways.</td>
<td>Harvey et al. (1961); Schroeder et al. (1967)</td>
</tr>
<tr>
<td>TABLE 1, continued</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perceptive-receptive/ systematic-intuitive</strong></td>
<td>The inclination to assimilate data into concepts or precepts previously held (perceptivity) versus the tendency to take in data in raw form (receptivity). The inclination to develop clear sequential plans (systematic) versus the tendency to develop ideas freely from data and to skip from the part to the whole (intuitive).</td>
<td>Mckenney and Keen (1974); Schwartz (1972) identified a related style that considers perceptive (&quot;generalizing&quot;) and receptive (&quot;particularizing&quot;).</td>
</tr>
<tr>
<td><strong>Leveling/sharpening</strong></td>
<td>Individual variations in assimilation in memory. The leveler tends to assimilate new stimuli into previous categories, while the sharpener tends to differentiate new information from old.</td>
<td>Gardner (1959)</td>
</tr>
<tr>
<td><strong>Cognitive complexity/simplicity</strong></td>
<td>Differences in tendency to see the world in a multi-dimensional way. Complexity is characterized by the use of hierarchic integration, while simplicity is shown in the use of dimensions of difference.</td>
<td>Harvey, Hunt, and Schroeder (1961); Kelly (1955)</td>
</tr>
<tr>
<td><strong>Scanning/focusing</strong></td>
<td>Entails the identification of relevant versus irrelevant information in attempting to solve a problem.</td>
<td>Schlesinger (1954)</td>
</tr>
</tbody>
</table>

continued, next page
<table>
<thead>
<tr>
<th>TABLE 1, continued</th>
<th>Constricted/flexible control</th>
<th>Constricted control shows more susceptibility or distraction; flexible control is characterized by resistance to interference.</th>
<th>Klein (1954)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad/narrow category width (equivalence range)</td>
<td>Preference for broad categories containing many items, rather than narrow categories containing few items.</td>
<td>Bruner and Tajfel (1961); Kogan and Wallach (1964); Pettigrew (1958)</td>
<td></td>
</tr>
<tr>
<td>Tolerance for incongruous or unrealistic experiences</td>
<td>Individual willingness to accept perceptions that vary from conventional experience. Tolerance is characterized by a greater adaptation to unusual perceptions. Intolerance is revealed by the demand for more data before the unusual is accepted.</td>
<td>Klein, Gardner, and Schlesinger (1962)</td>
<td></td>
</tr>
<tr>
<td>Strong/weak automatization</td>
<td>Relative ability to perform simple, repetitive tasks compared to what would have been expected from one's general ability level.</td>
<td>Broverman (1964)</td>
<td></td>
</tr>
<tr>
<td>Conceptual/perceptual motor dominance</td>
<td>Conceptual dominance is shown by relative specialization of conceptual behavior vs. relative specialization of perceptual motor behavior.</td>
<td>Broverman (1964)</td>
<td></td>
</tr>
</tbody>
</table>

continued, next page
<table>
<thead>
<tr>
<th>Sensory modality</th>
<th>Reliance on the different sensory nodes, especially kinesthetic (leading to figural or spatial thinking), auditory (leading to verbal thinking), enactive, iconic, and symbolic modes.</th>
<th>Bruner, Olver, and Greenfield (1966)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converging/diverging</td>
<td>Thinking aimed toward logical conclusions and uniquely correct or conventionally best outcomes, versus thinking aimed toward variety and quantity of relevant output.</td>
<td>Getzels and Jackson (1962); Cronback (1968)</td>
</tr>
<tr>
<td>Conceptual differentiation</td>
<td>Relative multiplicity of distinctions among concepts (as contrasted to the extent of a single concept's range of reference).</td>
<td>Gardner, Lohrenz, and Schoen (1968)</td>
</tr>
<tr>
<td>Compartmentalization</td>
<td>Discrete and relatively rigid categories involving a certain inertia in thinking and possible limitation in production of diverse ideas.</td>
<td>Messick and Kogan (1963); Wallach and Kogan (1965)</td>
</tr>
<tr>
<td>Conceptual articulation</td>
<td>Extent to which stimuli or items of information are treated in dimensional rather than class terms; i.e., extent to instances of a concept are discriminated from each other in a number of intervals or ordered categories within a concept's range of reference.</td>
<td>Bieri et al. (1966); Schroder, Driver, and Streufert (1967)</td>
</tr>
</tbody>
</table>
A portion of the recent cognitive style research covers the bipolar aspects cited on previous pages. David Kolb attempted to develop an experiential learning model of learning styles. The researcher developed the LSI consisting of the bipolar characteristics of concrete/reflective and abstract conceptualization/active experimentation.

Bernice McCarthy's work has been included in this section because of its bipolarity; however, the researcher has involved Brain Research also in the development of her 4MAT instrument. McCarthy has preferred to work directly with teachers in order that they might teach with style. McCarthy acknowledges that right and left-hemisphered processes are different, but both are important. In McCarthy's terms, an Analytic person is one who processes in terms of breaking down information into smaller features, which is basically what today's teachers practice. On the other hand, a Holistic person processes in terms of whole relationships between elements, which McCarthy feels teachers should practice more. Finally, the researcher identifies right-hemisphered people as being "circular" and left-hemisphered people as being "linear". Dunn, explained in a later section, also speaks in McCarthy's terms somewhat. Using her instrumentation, she identified characteristics of analytic and global learners as follows:
Analytic learner -- left-hemisphered, likes formal design, bright light, quiet environment, and no intake of food or beverage.

Global learner -- right-hemisphered, likes music, low light, informal design, and intake of food or beverage.

Crandall and Crandall researched the assessment of internal and external perceptions of individual control in both intellectual and academic environments. Called the Intellectual Achievement Responsibility Questionnaire, it has been used successfully with children as well as adults. The work of Hunt through the Paragraph Completion Method, determined the amount of structure needed by students within the classroom. Rotter has been largely responsible for the development of an internal/external type of scale which claims to measure the degree of control people feel they have over their immediate world (Locus of Control).

Brain Research

The area of Learning Styles and Brain Research has received much emphasis since Jung and Lewin (1935). Jung (1926) proposed three dimensions to learning—attitude (introversion/estraversion), perception (sensing/intuition), and judgement (thinking/feeling). Lowen (1982)
added a fourth dimension to Jung's theory, namely the dimension of style (contextual/detail orientation).

Soares and Soares (1982) presented a paper to the Congress of Applied Sciences emphasizing brain research as having illuminated the learning process. According to Heller (1987) of the University of Chicago, who researched the "right-brain, left-brain" process, creative, spatially-oriented people may be considered as "right-brained or hemisphered" thinkers. On the other hand, "left-brained or hemisphered" thinkers exhibit analytical or verbal orientations. While a right-hemisphered individual might prefer pictures, the left-hemisphered person would enjoy reading a paragraph complete with details.

As a portion of his research with right and left-hemisphered dominance, Robert Zenhausern developed the Differential Hemispheric Activation Instrument (DAT). The assessment is completed through the use of a paper and pencil instrument, containing twenty-six (26) items, which ask students to select a preference for a particular activity indicative of a spatial or verbal orientation. The researcher cites the term "neuroeducation", which applied to that aspect of education which is focused upon the interaction of the brain with the behavior of learning methods.

Richert (1982) also examined the issue of brain research and learning style. This researcher's preference was a "whole brain" approach to education, rather than dominance of one hemisphere over the other. Her assessment
also asks students to determine preferences. However, based upon this information, Richert has defined methods of teaching which allow representatives of each dominant hemisphere to stretch into the other hemisphere. This reinforced the work of Richert and Webb (1981) which determined that in order to be competent, it is necessary for the student to "team" both hemispheres and use both sides of the brain. The "whole brain" approach to teaching by Murphy and Talbach (1980) resulted in the "Look-See-Do" model to determine student hemispheric preferences by doing or listening and talking.

Blakeslee (1982) cautioned that there is a danger in learning styles approaches to teaching, when considering hemispheric knowledge. The danger lies in the possibility of development of one side of the brain and allowing development of the other to remain stagnant. He argues against working with one hemisphere favored by the individual, preferring to keep the mind in balance.

Gregorc (1983) listed similarities between the efforts of brain researchers and those of learning style researchers. He said:

1. The brain is differentiated in function: the two halves process different kinds of information in different ways. The hemispheres appear to "house" specific functions like analytical and synthetic processes, imagery and verbal responses, and simultaneous and successive processes in different sections. This supposition supports empirical evidence about the differences in stylistic responses to stimuli.
2. The two halves of the brain are connected and therefore function holistically. Despite reasonable specialization of the hemispheres, they indeed work together. This, in part, accounts for empirical evidence that people can register at least some information to varying degrees irrespective of its instructional technique. This fact also accounts for the generalized impression that we all learn the same way.

3. Certain environmental stimuli and cultural activities stimulate specific functions more than others. If these functions are well developed into an individual, the responses will be refined and clear. This, however, points to the biases regarding the balancing of our approaches.

4. Brain growth periods may occur in which certain data can be gathered and reinforced better than at other times in human growth and development. This lends credence to the empirical and psychological positions regarding styles, ages and stages, periods of absorption and reflection, transitions, and crisis periods in human life. (p.6).

Cognitive Mapping and Other Modalities

Joseph Hill and his associates at Oakland Community College in Michigan developed an instrument to build a cognitive style map for students. He noted that "Cognitive style is a unique means for describing an individual's mode of behavior in searching for meaning." In mathematical terms, \( C = (S) \times (E) \times (H) \) where \( C \) represents "cognitive style", \( S \) represents symbols and their meaning, \( E \) indicates cultural determinants, and \( H \) modalities of inference. Attempting to make his theory more scientific, Hill prepared a hierarchy of seven educational sciences. It consisted of the following:
1. Symbols and meanings
2. Cultural determinants
3. Modalities of inference
4. Educational memory (neurological, biological, electrochemical)
5. Cognitive style
6. Teaching, administrative, and counseling style
7. Systematic, analytical decision-making

This hierarchy was used by Hill in the development of his instrumentation method. Hill (1976), according to Semple (1932), believed that people assimilated the data from the environment through their senses—hearing (auditory), smell (olfactory), taste (savory), touch (tactile), and sight (visual). Barbe and Swassing researched these senses in the preparation of their instrument (SBMI) and preferred to call them "modalities", a term used by many researchers in the field. They defined a modality as "any of the sensory channels through which an individual receives and retains information" (p. 1). They viewed modalities in three specific ways: (1) fixed neurological characteristics; (2) preferences; and (3) measurable behaviors. In a 1979 publication; Barbe and Swassing cited the senses (modalities) of vision, hearing, and kinesthetic as having the greatest use in classrooms.

Other classifications of modalities have been prepared which differ from Hill's. Tindall (1980) discusses six modalities and related them to how children learn. They are:
1. Auditory Language (A student learns best by hearing the word spoken)
2. Visual Language (A student retains information best by reading it)
3. Auditory Numerical (This student learns best when oral explanations and numbers are given)
4. Visual Numerical (The student must see numbers written down in order to do best)
5. Kinesthetic (The learner must touch and/or experience in order to learn best)
6. Combination (To learn best, the student must combine auditory, visual, and kinesthetic activities)

In the same year, French also prepared a classification of modalities. He listed the strategies and prepared techniques teachers might employ to reach the students exhibiting particular strengths. The presentation is much like Tindall's.

<table>
<thead>
<tr>
<th>Style</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. motor/tactile</td>
<td>laboratory activities</td>
</tr>
<tr>
<td></td>
<td>manipulative activities</td>
</tr>
<tr>
<td></td>
<td>role play</td>
</tr>
<tr>
<td></td>
<td>(dis)assembly of equipment/objects</td>
</tr>
<tr>
<td>2. aural/visual</td>
<td>field trips</td>
</tr>
<tr>
<td></td>
<td>graphs and charts</td>
</tr>
<tr>
<td></td>
<td>audio-visual presentations</td>
</tr>
</tbody>
</table>
3. oral (interactive) small group discussion
    student reports and presentations
    question and answer periods
4. olfactory using senses of smell and taste in projects
5. print orientation paper and pencil tests
    calculation exercises
    use of course outlines

Canfield and Lafferty have also researched a number of differing modalities in preparation of the "Learning Style Inventory". In a February, 1981 issue of Educational Leadership (p. 374), the basis of this instrument is explained:

Individual learning style is derived from:
* academic conditions (relations with instructor and peers)
* structural conditions (organization and detail)
* achievement conditions (goal setting, competition)
* content (numbers, words, etc.)
* mode of preferred learning (listening, reading, iconic, and direct experience)
* expectation of performance (superior through satisfactory)

An instrument has been designed to detect perceptual modes, which, according to Reinert (1987), are the ways students internalize individual words. The Edmonds Style Identification Exercise (ELSIE) contains fifty (50) common
English words, which are read once at five-second intervals. The instrument defines four major modalities:

- Visualization
- Reading
- Listening
- Kinesthetic

Fischer and Fischer (1979) introduced the Observation of Style assessment, which identified ten (10) learning styles or modalities:

- The incremental learner (learns in small amounts)
- The intuitive learner (sudden insights)
- The sensory specialist (relies mainly on one sense for information)
- The sensory generalist (relies on all senses)
- The emotionally involved (likes a charged environment)
- The emotionally neutral (likes low key classrooms and little conflict)
- The explicitly structured (likes high structure and goals)
- The damaged learner (has poor self-concept, or social and/or cognitive skills)
- The eclectic learner (can change learning style according to room conditions)
- Open-ended structure (likes open classrooms)
Responsibility for commencing research into this area of style lies with Herman Witkin. Witkin has been called "the Father of Cognitive Style" in many a printed article. According to Avery (1985), Witkin was hired by the armed forces to determine why pilots tilted one wing or turned upside-down when flying through clouds. The development of the tilting chair - tilting room test arose through Witkin's study. Following additional study, a field dependent/field independent test was developed. The theory of field dependence and field independence is based upon the premise that one's ability to perceive is based upon either analytical or global perceptions. A field dependent person uses external sources of information, while a field independent person employs internal sources. In 1977, Witkin listed those professions which field dependent people joined (e.g. nursing, teaching) and those in which field independent blossomed (e.g. engineering, science).

Berthelot (1982) provided research evidence that females tended to be more field dependent than males. Additionally, he determined that a definite link could be proven between how teachers learn and how they teach. Career choices, he felt, were greatly influenced by teachers and experiences in the classroom.

Two instruments are generally associated with this style, the Group Embedded Figures Test (GEFT) and the Hidden
Figures Test (HFT). For the GEFT, the observer is requested to look at a complex pattern and find a simple, geometric form in it. The test is intended for groups, although the EFT, which is an individualized version of the GEFT, is also available. Although highly acclaimed as an accurate instrument for cognitive style identification (Oltman, 1982), some degree of skepticism does exist (Postman, 1955). Curry (1987), who has determined reliability and validity statistics for most learning styles instruments, provides a determination of good reliability and strong validity for these instruments.

Studies by Burstein (1980) and Morrell (1976) involving females and field dependence determined some interesting results. In these studies, females tended to be more field dependent and preferred to enter helping professions such as nursing and teaching.

Ramirez and Castaneda have focused their research on the development of individualized strategies which will meet the needs of each learner within the classroom. Primarily, these researchers aimed their studies at Mexican-American children. The reason for the selection of this particular group was that Mexican culture does not emphasize the same styles as the United States, according to Kirby (1979). It was believed that Mexican-American children were under constant stress, because the Mexican culture emphasized field dependence, while the American schools emphasized field independence. Studying young children required that the two
researchers employ an observation type instrument, which they did. The instrument, known as the Child Rating Form, is based upon the belief that style is not fixed, and that once it is determined, it can be changed.

**Leveling / Sharpening**

Studies into this theory of cognitive style commenced with Holzman and Klein (1954). Gardner (1959) built the Schematizing Test to assess individual variations in one's ability to estimate the size of one hundred fifty (150) squares projected on a screen. Those who were able to determine distinctions in small changes in size were considered to be "sharpeners", while those who were unable to do so were "levelers".

**Reflection / Impulsivity (Conceptual Tempo)**

Jerome Kagan, of Harvard University in Cambridge, MA completed studies on "Impulsive and Reflective Children" in 1965. Using the Matching Familiar Figures Test (MFFT), he determined individual differences in the speed and adequacy of information processing and concept formation. This was measured on a continuum, between the poles of reflection and impulsivity. This instrument consists of twelve pictures and six similar choices, of which only one is correct. According to the researcher, those exhibiting a reflective style gener-
ally require more time to produce correct responses than impulsives. Impulsivity, then, is characterized by quick responses, while reflectivity requires more deliberation. Impulsive persons, as might be expected, make more errors, by not reviewing all the possible alternatives prior to responding.

Recent research by Mamchur (1982), using the Action Oriented - Reflection Oriented (AORO) instrument, has provided educators with some interesting conclusions. Action-oriented students tend to focus toward people and things which surround them, while reflection-oriented students focus toward their own private world of ideas. The researcher considered this a valid instrument for improving teaching styles, since they contribute to increasing the capacities of the individual learner.

Scanning / Focusing

Kagan and Krathwohl (1967) developed a short questionnaire aimed at the college level to describe those students who either attempt to piece together a large picture (scanners), or those who focus on specific details of a learning situation (focusers). Schlesinger (1954) had previously examined this theory of cognitive style.
According to information provided by Dunn, Beaudry, and Klavis (1989), only three truly multidimensional instruments presently exist. The first such assessment is the NASSP Learning Style Profile, which was developed through NASSP funding between 1982 and 1986. Although the name of James Keefe, Director of Research for NASSP, is frequently associated with the instrument, it was actually the work of a task force, composed of a number of researchers, including Rita Dunn. The instrument contains twenty-three (23) scales representing four major learning style factors: instructional preferences (Keefe), study preferences (Dunn), cognitive skills (Witkin), and perception (Reinert). The scales are further divided into sub-categories, based upon the larger categories listed above. The rather lengthy assessment of forty-two pages is specifically designed for secondary students.

Kenneth and Rita Dunn have developed the second multidimensional instrument, known as the Learning Styles Instrument (LSI). Several versions are available, depending upon the subject's level. The LSI:P is adapted for primary students, the LSI for older students and the PEPS for adults. The research conducted by this couple and their colleagues/students is perhaps the best known of all instruments, based upon the amount of information prepared by them for maga-
zines, journals, and books. The researchers identify five specific elements related to learning:

1. Environmental (sound, light, temperature, and design)
2. Emotional (motivation, persistence, responsibility, and structure)
3. Sociological (colleagues, self, pair, team, authority, and varied)
4. Physical (perception, intake, time, and mobility)
5. Psychological (analytic versus global, field dependence versus field independence, and reflective versus impulsive)

Griggs and Price (1980) studied seventh, eighth, and ninth graders. They learned that gifted students preferred to learn alone, have no lectures, and that they were persistent, self-motivated, and perceptually strong. Wasson (1980) worked with gifted students and received the same results as Griggs and Price. Macmurran (1985) learned that providing snacks to those sixth-graders who needed them produced higher achievement and improved attitudes toward testing. Lynch (1981) learned that time preferences and teacher assignment affected truancy rates significantly. Price (also 1981) reported a study in New York of third through sixth-graders. Their preferences included mobility, formal seating arrangements, self-motivation, and low light among high achievers in reading. Additionally, these students did not prefer to read in the morning hours. A study
of mathematics achievers indicated that they preferred a formal design and mobility, which was quite like the preferences of the reading students. The environmental preferences of students was examined further by a number of researchers (Murra, 1983; Krimsky, 1982; Pizzo, 1981; Shea, 1983) and it was learned that students performed significantly better when the environment matched the student preference (e.g. temperature, light). A summary of several research studies involving Dunn-related instrumentation and high school students follows:

**TABLE 2**

Research using the Dunn LSI with secondary students

<table>
<thead>
<tr>
<th>RESEARCHER</th>
<th>POPULATION</th>
<th>FINDINGS</th>
</tr>
</thead>
</table>
| Cafferty, E.     | High School Teacher/Student Pairs | 1. The greater the match between the student's and teacher's style, the higher the Grade Point Average.  
2. The greater the mismatch between the two styles, the lower the Grade Point Average. |
| (1980) University of Nebraska |                          |                                                                          |
| Douglass, C.     | High School Students | 1. Deductive students taught through biology materials and inductive students taught through inductive materials each achieved better than when mismatched. |
| (1979)           |                      |                                                                          |

continued, next page
TABLE 2, continued

Tannenbaum, R. (1982) St. John's University
Tenth, Eleventh and Twelfth Graders
1. Field independent students provided low structure and field dependent students provided high structure performed better (significant level) when taught through matched methods.

1. When students were matched with their learning style preferences for a formal versus informal design, they achieved high scores at the .01 level of significance.
2. When mismatched, students who preferred an informal design achieved below their matched peers at a .01 level of significance.
3. Mismatched students who preferred a formal design were better able to adjust the environment to their needs than were mismatched students who preferred an informal design.

Seventh, Eighth, and Ninth Graders
1. Gifted students preferred learning alone and no lectures.
2. Gifted students were persistent, self-motivated, and perceptually strong.

Seventh through Twelfth Graders
1. Gifted students were highly motivated and perceptually strong.

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<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Institution</th>
<th>Grade Levels</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross, Jt., J.</td>
<td>Univ. of Alabama</td>
<td>Ninth through Twelfth Graders</td>
<td>Gifted students were self-motivated, internally controlled, self-directed, and task committed.</td>
</tr>
</tbody>
</table>
| Price, G., Dunn, K., Dunn, R., and Griggs, S. | | Fourth through Twelfth Graders | 1. Gifted students preferred options, formal design, no lectures, and learning alone.  
2. Gifted students were self-motivated, perceptually strong, and nonconforming. |
| Copenhaver, R. | Indiana University | High School Students | 1. Students' learning styles remained consistent regardless of the subject being studied.  
2. Significantly more positive attitudes resulted when student and teacher styles were similar.  
3. A wide range of learning styles existed in each class studied. |
| Lynch, P. | St. John's Univ. | High School Students | 1. When matched with their time of day preference and mismatched for teacher assignment, truant students attended school more frequently.  
2. A significant interaction (.01 level) occurred among the degree of truancy, learning style preference, and English teacher assignment, to suggest that time of day preference was a crucial factor in reversing truancy. |

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<table>
<thead>
<tr>
<th>Study</th>
<th>Grade Level</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Cody, C. (1983) Temple Univ. | Fifth through Twelfth Graders | 1. Gifted, highly gifted, and average students were significantly different in learning styles and hemispheric arousal systems.  
2. Gifted students preferred quiet, moderate temperatures, morning, and options.  
3. Highly gifted students preferred sound when learning, cool temperatures, evening, and more options than their gifted peers.  
4. Gifted and highly gifted students exhibited right-brain dominance. |
| Della Valle, J. (1984) St. John’s Univ. | Seventh-graders | 1. Significant differences were observed in achievement when mobility preferences were mismatched.  
2. Students whose preferences for mobility or passivity were addressed performed significantly better in achievement. |
3. There were significant differences between males and females when combining concrete experiences with abstract conceptualization.  
4. There were no differences between black and white participants. |

continued, next page
TABLE 2, continued

White, P. (1980) St. John's University
Seventh and Eighth-graders
1. A highly positive relationship was received between the LSI (Dunn) and California Psychological Inventory in the areas of persistence and responsibility.

Seventh-graders
1. Students performed better in an environment which matched their preferences (p < .10).

Seventh and Eighth Graders
1. Math students taught through preferences demonstrated better test scores.

Studies by the Dunns and their students/peers have provided a great deal of information regarding learning styles and the learning styles movement. Example studies have examined quiet versus sound, bright versus soft light, warm versus cool temperatures, formal versus informal design, and lecture versus group teaching (Dunn et al., 1985; Dunn, 1989). Populations of students from gifted and talented to learning disabled to average to disciplinary problem have been involved in numerous studies. All research conducted through St. John's University by Dunn et al provide the same conclusions—that students whose style is matched to the teaching environment perform better in class, test better on standardized tests, are more significantly
more motivated, and produce significantly fewer discipline problems than those whose style is not matched.

Another study examined temperature preferences on achievement of secondary students (Murrain, 1983). The study, conducted by the school's principal, determined that students performed significantly better when the temperature matched their preference. Environments were also documented in several other studies (Krimsky, 1982; Pizzo, 1981; and Shea, 1983).

Researchers occasionally disagree with each other's findings. An example is a 1981 study conducted by Rita Dunn and Maria Carbo. The research did not support earlier findings by Barbe and Milone (also 1981) in that students in primary grades were more auditory than visual and learned least well when taught kinesthetically. The findings may lie in differences in experimentation, environment, or other factors. The Dunns, to cite one example, research indicates that preferred methods or modes of learning are not as consistent as some researchers once thought. Satterly and Brimer (1977), only a few year earlier, had determined that personal preferences remained rather stable over time. In a middle-of-the road conclusion, Copenhaver (1979) indicated that learning styles remained consistent within subject areas but these changed over a period of time.

On the other hand, researchers frequently agree with each other in their findings. One such example involves
Price (1976, 1977) using the LSI, who indicated that researchers have found the following to be consistently true:

1. that each student learns differently from his/her peer
2. that the performance of a student in a particular class or subject area is related to how he/she learns
3. that when students are taught through their particular area of strength (modality), they perform better
4. that the development of a comprehensive learning style inventory or inventories is definitely possible.

Price conducted a number of studies through St. John's University. In one particular study of three hundred twenty-one (321) children in the third, sixth, and seventh grades from twelve (12) different schools, Price administered the LSI and another inventory, Gordon's "How I See Myself" Scale. Students were divided into groups, based upon their self-concept. Students exhibiting a high self-concept preferred an environment which was quiet and warm, were persistent, did not need mobility, did not exhibit an auditory preference, and enjoyed learning through several methods. Low self-concept students preferred a cool and noisy environment, were not persistent, needed mobility, exhibited auditory preferences, and also preferred to learn through several methods. In another study by Price (1982), eighty-five
students from grades three through six in three different schools in New York were tested with the LSI and PEP (Pupil Education Program) in the areas of reading and mathematics. Here, high achievers showed preferences for low light, formal design, high motivation, and mobility. In addition, they did not prefer food intake and did not prefer to work in the morning.

The third comprehensive instrument has been declared to be Hill's Cognitive Style Mapping, discussed earlier. However, other researchers have indicated that their particular instruments are multidimensional, as well. Included in this group is the TLC Learning Preference Survey, as developed by Hanson, Silver, and Associates. According to monographs by Silver (1986), this instrument holds strong reliability and strong validity. The assessment measures four particular learning styles: personal, innovative, analytic, and pragmatic.

Another instrument, developed by Malcom, Lutz, et al, which measures four elements of learning style is the LSIS. The researchers define learning style as "the method an individual uses to handle situations or obstacles which impede success socially and academically." The theoretical construct included the following four elements: (I) Intrapersonal, (E) Extrapersoinal, (CD) Cognitive Development, and (SC) Self-Concept. Then, using a multidimensional approach, the researchers presented five components, each with a varying degree of inclusion of the elements.
Style I: I > E, CD < SC

Style II: I < E (both are low, however), SC is low, CD is limited

Style III: E > I, SC is low, CD is average

Style IV: All four areas are high

Style V: All areas are high, but not quite as high as Style IV.

Learning Style Definitions

A review of terminology used by various researchers indicates that each defines the concept of learning style differently. While Schmeck speaks of "shallow and deep information processing," Dunn and Dunn emphasize "stimuli and elements". Gregorc speaks of "distinctive behaviors."

Specific definitions of three researchers are explained below. According to Dunn (1987),

Learning style is the way in which each person absorbs and retains information and/or skills; regardless of how that process is described, it is dramatically different for each person (p. 13).

Gregorc (1985) preferred to define the concept as,

Learning style from a phenomenological viewpoint, consists of distinctive and observable behaviors that provide clues about the mediation abilities of individuals (p. 19).
Keefe (1986) defines learning style, using yet different terms.

Learning style is made up of cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (p. 45). Each definition reflects the particular researcher's viewpoint, whether it is Cognitive (Gregorc) or multidimensional (Dunn).

**Learning Style Inventories**

Dunn and DeBello (1981) summarized learning style inventories. The summary has been replicated in Table 2.

In addition to the above inventories, a number of additional assessments have been produced through other sources. Letteri researched the issue of Cognitive Profiles. This instrument determines an individual's thinking patterns and procedures/strategies involved in the thinking process. Various dualities are examined: field dependence/independence; scanning/focusing; reflectiveness/impulsiveness; simplicity/complexity. Learners are broken into various types, depending upon the results of the assessment. A Type I learner, for example, would be more analytic than a Type III learner.

A 1982 instrument, the Myers-Briggs Type Indicator (MBTI), has been cited as having implications not only
to educational style, but also for organizational and family life. Developers were Isabel Briggs Myers and Katherine Briggs. Four dualities are scored in order to arrive at a person's learning type: Extraversion (E)/Introversion (I); Sensing (S)/Intuition (N); Thinking (T)/Feeling (F); and Judgement (J)/Perception (P). A table is presented showing different combinations of the above in order to assist the subject in locating his/her style or type. The instrument identifies sixteen (16) types of style and the table also explains each type, characteristics, pitfalls to avoid, and strengths associated with each style. Maier (1986) employed the MBTI in an assessment of learning styles of second-year nursing students. The purpose of the study was to determine the effects of various instructional techniques on achievement scores. Results indicated no significant differences between groups showing different scores on the MBTI. An editorial in the Learning Styles Network Newsletter cited problems with the MBTI as a learning styles inventory. The MBTI, according to Dunn (1988), is a "personality index" rather than a learning styles instrument. Upon further investigation, Dunn determined that the grouping arrangement for the study was such that it was invalidated. The demonstration of matched and mismatched effects was not proven because the instructors' styles were not controlled and other variables intervened with the research to result in incorrect data. One hundred forty-three (143) items are in-
cluded in this assessment, which, according to Curry (1987) holds strong validity and good reliability.

Ninety (90) items are included in the Student Learning Styles Questionnaire, as developed by Grasha and Reichmann. The instrument is hand-scored and thus provides a self-report to the student taking the assessment. Six learning styles are assessed: independent, avoidant, collaborative, dependent, competitive, and participant. Curry (1987) cites fair reliability and fair validity for this instrument, which has been used with college students mostly.

Energetic Model of Style

The Energetic Model of Style is a theoretical construct designed by Anthony Gregorc, which serves as the basis for the development of his learning styles assessment. The researcher notes (p. 21) that this construct is designed to help individuals divide experiences into temporary intellectual compartments in order to study various qualities of the mind. In other words, Gregorc believes that this model allows individuals to reflect upon their experiences within the environment in order to consciously clarify their "constitution in relation to the environment" (p. 23). A portion of this model includes Gregorc's mediation theory which states that:
The mind has qualitative mental channels through which it receives and expresses data most efficiently and effectively. The channels are used to create an individual's reality. (p.23)

Organon Model of the Mind

The Organon System serves as a means of describing the reality-creating functions explained by the Energic Model in that it has been described by Gregorc as his viewpoint regarding how and why the mind functions and how this is accomplished through the human personality. Since the early 1970's, Gregorc has accumulated data through direct observations, interviews, and other documents in his research of this system. This system, according to the researcher (p. 44) rests on the philosophical principal that "the primary purpose of life is to realize and actualize one's individuality, spirituality, and collective humanness."

As a result of observations and interviews, Gregorc identified common themes and behaviors, which led to the following beliefs (Gregorc, 1982):

* Every human being has universal qualities which are common to all other human beings.

* Every human being is unique unto himself, physically, emotionally, intellectually, and intuitively.

* Every human being is equipped to realize and actualize both his universal and unique qualities.

* Every human being is goal-oriented to survive and be fulfilled physically, emotionally, intellectually, intuititionally, and spiritually.
Every human being exists with an outer, objective world which can promote or frustrate the realization and actualization of his universality and uniqueness.

Every human being has an inner, subjective psychic life, consisting of the weightless and formless properties of purpose, perception, conception, apperception, love, and will.

Every human being has a mind which functions as a reality-creating instrument to align his inner psychic life with the outer world.

Every human being's purposes in life are fulfilled and experienced when a product and/or performance of that human being is expressed and manifested in the outer world.

In Gregorc's (1982) terms, "the ORGANON System manifests itself through the human personality. (It studies) two mediation abilities of the mind: perception and ordering." (p. 37)

**Mediation Abilities**

Gregorc has indicated in speeches that his interest in learning style was enhanced as a result of his experiences as a teacher, school administrator, and college professor. The researcher suggests that one perceives in two different ways, abstractly or concretely. These, he places on a continuum:

ABSTRACT--------------------------CONCRETE

According to Gregorc,

**Abstractness**

This quality enables you to grasp, conceive, and mentally visualize data through the faculty of reason and to emotionally and intuitively register and deal with
inner and subjective thoughts, ideas, concepts, feelings, drives, desires, and spiritual experiences. The quality permits you to apprehend and perceive that which is invisible and formless to your physical senses, sight, smell, touch, taste, and hearing.

Concreteness

This quality enables you to grasp and mentally register data through the direct use and application of the physical senses. This quality permits you to apprehend that which is visible in the concrete, physical world through your physical senses of sight, smell, touch, taste, and hearing. (p. 5)

Although everyone has the capability of using both forms of perception, one is generally favored over the other. Likewise, Gregorc views the mind as being able to order information taken in through one of two methods, sequentially or randomly. Again, each is placed on a continuum:

SEQUENTIAL------------------RANDOM

Gregorc explains,

Sequence

This quality disposes your mind to grasp and organize information on a linear, step-by-step, methodical, predetermined order. Information is assembled by gathering and linking elements of data and piecing them together in a chain-like fashion. This quality enables you to naturally sequence, arrange, and categorize discrete pieces of information. It further encourages you to express yourself in a precise, progressive, and logically systematic manner.

Randomness

This quality disposes your mind to grasp and organize information on a nonlinear, galloping, leaping, and multifarious manner. Large chunks of data can be imprinted on your mind in a fraction of a second. Information is also held in abeyance and, at any given time, each piece or chunk has equal opportunity of receiving your attention. Such information, when brought into order, may not adhere to any prior or previously agreed arrangement. This quality enables you to deal with numerous, diverse, and independent
elements of information and activities. Multiplex patterns of data can be processed simultaneously and holistically. This quality encourages you to express yourself in an active, multifaceted and unconventional manner. (pp. 5-6)

People tend to prefer one method of ordering over the other, as well.

Like many other researchers (Myers and Briggs, 1926; Golay, 1982; Kiersey and Bates, 1978), Gregorc based his work and subsequent developments upon those of Carl Gustav Jung. Jung, in the 1920's, had proposed three dimensions to learning—attitude (introversion/extraversion), perception (sensing/intuition) and judgement (thinking/feeling), which were cited earlier. Lawrence (1987) has considered Jung's theory to be one of the most comprehensive, current theories to explain the behavior of humans. Like Jung, Gregorc and others observed behavior patterns in the process of developing their models. Following Jung's belief that in order for a particular perception to remain in one's consciousness, the judgement processes must be involved, Gregorc formulated his mediation abilities.

Through the combination of both perception and ordering abilities, Gregorc developed four patterns: Concrete Sequential (CS), Abstract Sequential (AS), Concrete Random (CR), and Abstract Random (AR).
Concrete Sequential

The Concrete Sequential (CS) is considered to be a practical person, whose world of reality consists of the concrete world of the physical senses. This person completes projects in a step-by-step, linear fashion, considered by many to be a methodical and deliberate way of accomplishing activities. The CS will accept the word of an accredited expert and is best at duplication, rather than being original or creative. His/her world is ordered, practical, quiet, and stable. The CS is logical and very succinct in expression. His/her major evaluation terms are words like "good" or "not bad". The CS is very possessive of materials. The trademark of the CS is efficiency. Another descriptive term for this individual is the fact that he/she does not like change, and therefore, finds it very difficult to break any habits. The CS student likes to be knowledgeable to what the teacher's expectations are and dislikes classrooms where everything is not placed in an orderly fashion. In writing, the CS uses concise, clear wording, with no flowery additions.

Gregorc (1982) listed those characteristics which were intolerable to the CS, as well as this style's negative characteristics. He states:

Major Intolerances are cited as indicated below, and in general, the dominant Concrete Sequential dislikes:
*physical and environment conditions which are not conventionally correct,

*individuals who are flagrant violators of norms,

*broken promises and "surprises",

*people who procrastinate,

*discussions which appear to be "academic" rather than down-to-earth, and

*individuals who are "too emotional" in their decision making.

Negative Characteristics

*inflexibility and rigidity,

*excessive criticism and skepticism even though they themselves dislike being criticized,

*viewing people as "objects" to be controlled and owned,

*addiction to routine and order,

*susceptibility to autocratic and dogmatic belief systems,

*entrenched materialism coupled with unwillingness to give credence to an invisible world,

*lack of sympathy and compassion,

*an unforgiving, grudge-holding temperament, accompanied by an explosive anger and self-righteous attitude. (p. 21)

Abstract Sequential

Abstract people enjoy using the work "excellent" to describe a student's work or a particular project. Their world is probable, one which is based upon the concrete world of reality, but which is not step-by-step. These people are
analytical and intellectual. They frequently appreciate the advice of experts but depend upon their personal experiences as well. The AS world is quiet and ordered, but non-authoritative. The AS uses multi-syllabic words in a precise, rational way. The AS is highly verbal, opinionated, aloof, and frequently sarcastic.

Gregorc cites intolerances and negative characteristics for this style, as well:

Major Intolerances

In general, the dominant Abstract Sequential dislikes:

* hazy or sentimental thinking which leads to loose or inaccurate conclusions,

* ideas or claims which do not meet his rational test of logic or approved test of validity,

* metaphors and emotional stimulants in sounds and gestures, and

* boisterous activity and excessive rules and regulations.

Negative Characteristics

In general, Abstract Sequential behavior may manifest itself as follows:

* discrediting and devaluing other viewpoints by calling them mystical, plodding, off-the-wall, irrational, and unsubstantiated,

* getting lost in their ideas and building "castles" in the air (Ivory Tower Syndrome),

* believing their thoughts to be reality and failing to test them in the concrete world,

* absentmindedness,

* argumentative, excessively skeptical, and harshly critical,
coldness and isolation,

*taking a person's idea and reducing it to something trite or mundane in order to make it sound quite common,

*the use of polysyllabic words to inflate their ego, to confuse others, and to "put people in their place". (p. 26)

Concrete Random

The Concrete Random's world is possible. It is a creative world of activity, involving intuition. The world is multi-dimensional and definitely not ordered. CR people enjoy using words like "great" or "superior" to explain activities and events around them. They are informative and very lively. According to Gregorc (1988), approximately fifteen percent of the population has this learning style, and many concrete random people have difficulty adapting to the world in its present manner, ending in the serving of a jail term. The CR is competitive and unrestricted. He/she, however, is deceitful and unscrupulous. The CR likes to apply his/her knowledge to any setting and prefers personal proof to that offered by experts. In fact, very rarely will a Concrete Random accept the advice of a supposedly more knowledgeable person. CR people are impulsive and instinctive, as well as futuristic.

Gregorc provides the following intolerances and negative characteristics:
Major Intolerances

In general, the dominant Concrete Fandom dislikes:

* people who are unwilling to change or consider options,

* fence-straddlers who continually seek "hard data" and/or guarantees that the CR's ideas will or do work,

* procedures which must be followed with exception,

* being asked to prove that the faculty of intuition exists, and

* fuzzy-header "mystics" whose approach to life destroys the credibility of insights and premonitions.

Negative Characteristics

* bandwagoning and jumping from idea to idea without proper grounding,

* ruthless use of any means to the chosen end,

* abandonment of an idea or evolving project before it is fully completed,

* forgetting promises or agreements due to an "out-of-sight, out-of-mind" attitude,

* disinterest in practical ramifications of an idea which is to be implemented,

* irritation at other individuals who cannot make his intuitive leaps,

* the willingness to sacrifice himself and others in order to fulfill a mission, and

* jumping to "too quick" and rapid conclusions. (p. 37)

Abstract Random

The world of the Abstract Random is full of emotion and feeling. The world is multidimensional, not ordered. These people are perceptive, yet critical. They employ an inner
guidance system in order to validate information around them. The Abstract Random enjoys using flowery language, such as metaphors. He/she is active and colorful. Words like "super" or "fantastic" are used frequently by this style. They have much imagination and enjoy all aspects of the arts. They appreciate memories of the past, such as letters from old boyfriends or antiques passed down through generations. Their enthusiasm shows a jest for life, but, while being very outgoing, the AR also holds some degree of quietness. The Abstract Random is often messy, with unmade beds, dirty dishes, and desks where the top is littered with junk.

Gregorc cites the intolerances and negative characteristics here as well:

**Major Intolerances**

In general, the dominant Abstract Random dislikes:
- dogmatic and strictly logical systems of thoughts,
- cold, "noncaring", nonspiritual, and unemotional people,
- conservative and restrictive environments,
- being forced to "justify" his feelings,
- being required to quantify his qualitative experiences, and
- being continually told to be "realistic".

**Negative characteristics**

- chronic tardiness to meetings and the failure to meet deadlines,
- anchoring in ego-centered "me-first" attitude and thereby disregarding the rights and needs of others,
inac
curacy, and inattention to task and
detail which earn him the title of "off-the-wall
flake";

extreme moodiness due to the inability to balance his
experiencing of the extremes of emotions,

excessive worrying and self-doubt,

jealousy and over-dependency on others,

strong passions and extravagance, and

inflated self-image. (p. 32)

Dominant Style Traits

In order to transform the results of the Delineator in-
to particular characteristics, such as those cited above,
Gregorc (1982) developed a series of categories designed to
indicate the methods by which individuals interact with
their environment. They are:

World of Reality
Ordering Ability
View of Time
Thinking Processes
Validation Process
Focus of Attention
Creativity
Environmental Preference
Use of Language
Primary Evaluative Words
In recent years, researchers have begun attempting to adapt their instrumentation to classroom use. The most frequently employed instrument is that developed through the Dunns (LSI, LSI:P, and PEPS). However, McCarthy's 4MAT, Gregorc's Delineator, and the MBTI have also received some recognition. A recent publication (1988) by the Learning Styles Network cites school systems throughout the United States which presently apply the results of the Dunn LSI within their districts. For instance, large districts, such as Chicago and areas of New York City, as well as rural schools in Wyoming and Texas, all use a learning styles approach.

Following a Minnesota school district's hiring of Anthony Gregorc as a consultant to assist in determination of teacher style, the District continued with its emphasis on style by hiring Kathleen Butler, a colleague of Gregorc. Butler has taken Gregorc's instrumentation to the point of practicality by authoring a book and other information involving this approach to the Delineator to the everyday classroom. She has assisted teachers in implementing the SDI, which uses the Delineator in its practical classroom approach.
TABLE 3
Comparison of learning style assessments

RESEARCHERS AND THEIR DEFINITIONS OF STYLE

1) CANFIELD AND LAFFERTY.
Individual learning style is derived from: (a) academic conditions with instructor and peers; (b) structural conditions (organization and detail); (c) achievement conditions (goal setting, competition); (d) mode of preferred learning (listening, reading, iconic, and direct experience); and (e) expectation of performance level (superior through satisfactory).

2) DUNN, DUNN, AND PRICE.
Learners are affected by their: (a) environmental (sound, light, temperature, and the need for a formal or informal design); (b) emotional (need for either structure or options, persistence, motivation, and responsibility); (c) sociological (self, pair, peer, adult, or varied); (d) physical (perceptual strengths, need for intake, time of day or night energy levels, and need for mobility); and (e) psychological (global or analytic, reflective or impulsive, and cerebral preference) preferences.

INSTRUMENT(S)

LEARNING STYLE INVENTORY: Rank ordering of choices to 30 questions. Junior High through adult levels. Administration time: 15 minutes.

LEARNING STYLE INVENTORY (LSI): Rank ordering of choices for 104 items; Grades 3-12. Administration time: 30 minutes (approx).
LSI:P: 12 charts for children in grades 1 through 3. Administration time: varies.
PRODUCTIVITY ENVIRONMENTAL PREFERENCE SURVEY (PEPS): 100 items are rank selected for adults. Administration time: 30 minutes (approximately).

continued, next page
TABLE 3, continued

3) ENTWISTLE.
The Inventory of Approaches to Studying determines six different styles of learning: (a) achievement orientation; (b) reproducing orientation; (c) style of operation; (d) meaning dimension; (e) style of composition; and (f) versatility.

4) GARDNER.
Learning style may be identified as involving either sharpening or focusing.

5) GRASHA AND REICHMAN.
Learning style consists of three bipolar scales: (a) dependence/independence; (b) avoidance/nonavoidance; and (c) collaborative/noncollaborative.

6) GREGORC.
Learning style consists of distinctive, observable behaviors that provide clues to the functioning of people's minds and how they relate to the world. "Mind" qualities suggest that people learn in combinations of dualities: (a) concrete-sequential; (b) concrete-random; (c) abstract-sequential; and/or (d) abstract-random.

SHORT INVENTORY OF APPROACHES TO STUDYING: Responses to 64 questions on five-point scale. High school students. Administration time: 15 minutes.


STUDENT LEARNING STYLES QUESTIONNAIRE: Assesses ratings on five-point scale to 90 items for high school or college students. Administration time: 15 minutes.

STYLE DELINEATOR: Self-report instrument based on a rank ordering of four words in each of ten sets. Used with upper junior high through adult levels. Administration time: 5 minutes.

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7) HILL.
Cognitive style is the unique way in which an individual searches for meaning. It is reflected in the way: (a) qualitative and theoretical symbols are handled; (b) cultural influences affect the meaning given to symbols that are perceived.

8) HUNT.
Learning style describes students in terms of those educational conditions under which they are most likely to learn and essentially describes the amount of structure individuals require.

9) KAGAN.
Learners are either reflective or impulsive.

10) KEEFE et al.
Learning style consists of four major factors: (a) instructional preferences; (b) study preferences; (c) cognitive skills; and (d) perception. These scales are further divided into eighteen sub-categories.
TABLE 3, continued

(11) KOLE
Learning style is a result of hereditary equipment, past experience, and the demands of the present environment combining to produce individual orientations that give differential emphasis to the four basic learning modes postulated in experiential learning theory: Concrete Experience (CE); Reflective Observation (RO); Abstract Conceptualization (AC); and Active Experimentation (AE).

12) LETTERI.
Learning style involves four sets of dualities: (a) scanning/focusing; (b) field independence/field dependence; (c) tolerance/intolerance; and (d) cognitive simplicity/cognitive complexity.

13) MALCOM, LUTZ, et al.
Learning style consists of four types: Style I (undisciplined); Style II (withdrawn); Style III (follower); and Style IV (confident).

LEARNING STYLE INVENTORY: Self-report instrument based on a rank ordering of four possible words in each of 9 different sets. For use with secondary students and young adults. Administration time: 5-10 minutes.

COGNITIVE PROFILES: Observation instrument used with secondary students. Administration time: varies.

LEARNING STYLE IDENTIFICATION SCALE: Instrumentation based upon several observations. Rating is by the observer. May be used with students in grades 1-12. Administration time: varies.

continued, next page
TABLE 3, continued

14) McCARTHY.
   Learning style consists of perceptions and processes. Children perceive by thinking or sensing/feeling. They process by doing or watching. Learners are categorized as Type I, II, III, or IV, based upon their particular style.

15) MYERS AND BRIGGS.
   Learning style includes four scales: (a) extraversion/introversion; (b) sensing/intuition; (c) feeling/thinking; and (d) perception/judgement.

16) FAMIREZ AND CASTANEDA.
   Cognitive style differences (field independent/field sensitive) and cultural differences create individual learning styles. Because learning style is not permanently fixed, it is possible to intervene and affect it.

17) REINERT.
   Four perceptual modalities are the basis for learning style: written, sound, visualization, and activity.

4MAT: Eight-step cycle of instruction based upon responses to questions. Used with all levels (elementary - adult). Administration time: 40 minutes.

MYERS-BRIGGS TYPE INDICATOR: 143 items in a forced-choice situation. Used with college students. Administration time: 40 minutes.

CHILD RATING FORM: Direct observation checklist indicating frequency of various behaviors. Used with elementary students. Administration time: varies.

EDMONDS LEARNING STYLE IDENTIFICATION EXERCISE: 50 common English words read at intervals. Administration time: 10 minutes.

continued, next page
TABLE 3, continued

18) SCHMECK.

Learning style is the product of the organization of a group of information processing activities that individuals prefer to engage in when confronted with a learning task. Those activities range from (a) deep and elaborative to (b) shallow, repetitive, and reiterative.

19) SILVER.

Learning style consists of four different student preferences: personal, innovative, analytic, and pragmatic.

20) WITKIN.

Learning style consists of one duality: field dependence and field independence.

21) ZEHNASEN.

Each hemisphere of the human brain controls a particular behavior. Thus, learning style consists of right or left-hemisphered thinking, or a combination of the two.

INVENTORY OF LEARNING PROCESSES: 62 items, true-false format. Administration time: 20 minutes.

TLC LEARNING PREFERENCE SURVEY: Multi-dimensional instrument developed for use with all levels. Administration time: varies.

GROUP EMBEDDED FIGURES TEST: 18-25 items for high school - adults.

DIFFERENTIAL HEMISPHERIC ACTIVATION INSTRUMENT: Forced choice preference format with 26 items. Used with all levels. Administration time: 15 minutes.
CHAPTER III
METHODOLOGY

Chapter III communicated the research plan. Subtopics address study questions, sample and instrumentation, the research design, procedure and timelines and data analysis methodology.

Questions

The study addressed questions related to the four general purposes outlined in Chapter I.

Relationship I: Matches in the learning style of students/teachers and students' academic performance.

Question 1

What are the mediation abilities (teaching styles) of grade 12 English teachers in the Narragansett Regional School District?

Question 2

What are the mediation abilities (learning styles) of grade 12 students at Narragansett Regional High School?
Question 3

Is there a positive correlation between the degree to which students and teacher learning styles match and the students' achievement in English?

Relationship II: Matches in the learning style of students/teachers and students' school attendance patterns.

Question 4

Is there a relationship between attendance and compatibility of teacher and student learning style?

Relationship III: English teachers' capacity to predict the learning styles of students enrolled in their classes.

Question 5

How well do the teachers in the study predict the individual learning styles of their students?

Question 6

Is there a relationship between length of acquaintance of the teacher with the student and his/her ability to predict learning styles?
Relationship IV: Student sex and cognitive style on the one hand and student mediation traits (perception and ordering) on the other (within different ability grouped twelfth grade classes).

Question 7

Is there a correlation between sex of the students and achievement?

Question 8

Is there a predominance of students favoring English (including grammar, literature, and composition) class and the matching of student and teacher style?

Selected Population

The school selected for the study was Narragansett Regional High School, a school composed of 641 students in grades 7 - 12. The Narragansett Regional School District includes the towns of Templeton and Phillipston, which are both rural communities in North Central Massachusetts. The October 1, 1989 school data report indicates the entire school population consists of 1331 students. 99.97% of the population is white, with the remaining .03% consisting of Black, Asian, and Hispanic families. Both communities i-
clude families consisting of primarily blue collar workers, with the majority having completed high school. Recent surveys indicate that new residents include white collar, college graduates with no children. Templeton, which consists of four precincts, is the larger of the two communities with a population of 5700. Phillipston has nearly 3000 residents. Income is generally quite low, with teacher salaries being 345 out of 351 cities and towns rank-ordered in Massachusetts. There is little business, aside from two manufacturers. Lay-offs are extensive. The communities have no grocery stores, medical facilities, or full-time fire department. Approximately 50 percent of the students in the Narragansett Regional School District pursue advanced study upon graduation, generally involving courses at nearby Mount Wachusett Community College.

Ninety-nine (99) grade 12 students participated in the study. Grade 12 students were selected because the Gregorc Delineator, according to Gregorc, has been designed for upper-grade students and adults, and the terms employed in the instrument may be too difficult for juniors or sophomores to understand. Due to the small size of the school, the sample reflected the total class, rather than a segment. A letter (Appendix A) was sent to the parent of each grade 12 student, prior to the commencement of the study, requesting approval for participation. Parents were given the opportunity to examine the instrument, the Gregorc Delineator, by contacting the office of the Curriculum Coor-
ordinator and arranging for an appointment. One parent refused to allow her child to participate. Students were also invited to participate in the study, through a classroom visitation by the researcher.

Teachers selected for the study were grade 12 English teachers at the school. The sample represented the entire staff from the English Department responsible for teaching seniors. Prior to beginning the study, they participated, along with other staff members, in a one-half day workshop on Learning Styles. Workshop leaders were former students of Anthony Gregorc, Linda Badgley-Hadlock and George Johnson, who provide workshops on learning styles to school districts throughout Massachusetts. The Gregorc Delineator was the instrument administered to teachers participating in the study.

Instrumentation

The instrument used in the study was Gregorc's Style Delineator. Copies were provided to each person involved in the study. A description of the instrument is located in Appendix B.

Reliability

Internal consistency and stability were examined by Gregorc (1982) with regard to the Delineator. Determina-
tions were made as to the extent to which the four scales of the Delineator exhibited internal consistency as represented by a standardized alpha and also the extent to which scores of one group of adults predicted the same group of adults. Gregorc cites a standardized alpha coefficient indicating a strong internal consistency, due to the high range of correlation, between 0.89 and 0.93. Gregorc then examined the repeatability of the Delineator to determine its stability. Through another table, the test-retest correlation coefficients were cited as being significant at the $P < .001$ level or less, with results ranging between 0.85 and 0.88. Thus according to the researcher, both coefficients indicate that the Gregorc Style Delineator exhibit strong reliability. One hundred ten (110) subjects were administered the Delineator two times in order to complete the statistics for reliability.

**Predictive Validity**

Gregorc (1982) asked the question, "To what extent do the scores of the Delineator predict scores of subjects' self ratings of characteristics attributed to individuals classified by the Gregorc Delineator?" The null hypothesis stated that no relationship existed. The researcher determined that a relationship at the $P < .001$ level between the Delineator scores and attribute scores existed. The relationships ranged between a low score of $r = .55$
Concrete Random) to $r = 0.76$ (Abstract Sequential). One hundred ten (100) subjects were administered the Delineator twice and were requested to respond to a number of selected items classified by the instrument being employed in order to make the above determination.

Research Methods

One hundred twenty-one administrators and teachers in the Narragansett Regional School District participated in a workshop on Learning Styles. During the workshop, they had an opportunity to complete a self-assessment, using the Gregorc Delineator. Members of the staff, who teach grade 12 English, were then invited to participate in the study. Prior approval for the use of materials and staff/students at Narragansett Regional High School had been granted by the School Committee, Superintendent, and Principal. A meeting was held with seniors in the high school and they were invited to participate. Parents of grade 12 students received a letter inviting them to allow their children to participate in the study, as well. Students and teachers who agreed to participate completed the Gregorc Delineator in order to determine their Learning Styles.

English teachers were asked to predict the learning style of each of their grade 12 students. Each teacher was also requested to indicate the length of time he/she has
been acquainted with each student and under what circumstances.

Collection of date consisted of results of the Delineator used by teachers and students, as well as teacher predictions of student learning styles. Upon completion of the first term of the 1989-1990 academic year, the researcher obtained the English marks and attendance records of all students participating in the study for purposes of analysis.

Time Table

Summer, 1989: Meetings with Superintendent, School Committee, Principal and presentation of proposal to them for review and approval.


Fall, 1989: Visitation by consultant at workshop (October 17)

Meetings with English teachers and grade 12 students

Parent letters sent home

Distribution of Gregorc Delineator to participants

Teacher predictions of student styles

Winter, 1990: Additional review of literature, as necessary
Discussion of results to date with staff/students
Review of student first term grades
Review of student attendance for first term

Spring, 1990:
Completion of statistical analyses of results
Preparation of dissertation (final form)
Oral examination (Forms 8, 9)
Completion of final requirements for degree

Data Analysis

The data analysis focused upon patterns of behavior, based upon measures of central tendency, measures of dispersion, and several tests of statistical significance. Given the small teacher sample size, no standard deviations were determined; however, student data included the standard deviation. A "t" test, with a level of significance of .05 was employed with questions involving the matching of teacher style and student style, the correlation of absentee rate with learning style matching, and the correlation of matched style between teachers and student and sex of each. For the remaining portions of the study analysis, the Chi Square and Cramer's V were selected. The level of significance was determined at a .05 level. With the importance of student grades in the study, the mean, standard deviation, mode and median were also determined. Upon
completion of the statistical analysis, the results were summarized and implications drawn. Suggestions for further study and study problems were discussed.
CHAPTER IV
RESULTS

Data obtained pertaining to relationships between student learning style/teacher teaching style and academic achievement and school attendance are analyzed in Chapter IV. These data are focused upon eight questions:

1. What are the mediation abilities (teaching styles) of grade 12 English teachers in the Narragansett Regional School District?

2. What are the mediation abilities (learning styles) of grade 12 students at Narragansett Regional High School?

3. Is there a positive correlation between the degree to which students' and teacher's learning styles match and the students' achievement in English?

4. Is there a relationship between attendance and compatibility of teacher and student learning style?

5. How well do the teachers in the study predict the individual learning styles of their students?

6. Is there a relationship between length of acquaintance of the teacher with the student and his/her ability to predict learning style?

7. Is there a correlation between sex of the students and achievement?
8. Is there a predominance of students favoring English (including grammar, literature, and composition) class and the matching of student and teacher style?

Sources of data are ninety-nine (99) students and four (4) teachers at Narragansett Regional High School. All teachers are grade twelve English teachers and all students are members of the senior class at the same high school. The total population of the senior class consisted of one hundred (100) students at the time of data collection. One student declined to participate in the study. All Delineators completed by the sample members occurred under the direction of the researcher, using a step-by-step process.

Demographic characteristics of the study follow the introductory remarks to Chapter IV. Four sub-topics, each in conjunction with the Relationships outlined in Chapter III, focus upon the eight (8) questions which serve as a catalyst for the data presentation in Chapter IV. Frequency distributions summarize all data collected in response to questions addressed in the study. A "t" test and pearson correlation coefficient analyze the data for Question 3. A "t" test and pearson correlation coefficient assess the compatibility of attendance and student/teacher learning style (Question 4). A Chi Square was conducted to analyze data from Question 6. A "t" test and pearson correlation coefficient summarize Question 7, while analysis of
Question 8 involved a Chi Square. The chapter concludes with a summarization of the results of the study.

Raw data revealed that a number of subjects in the study presented two equally dominant or very closely-related dominant scores, which may or may not have been influential in further analyses. Prior to calculation of frequency distributions, the difference between the highest dominant individual learning style score and the second highest score (next highest in dominance) were determined.

Analysis of Student Dominant Scores

Table 4 analyzes the differences between the two most dominant learning style scores for students assessed in the study.
Table 4
Differences between two most dominant scores

<table>
<thead>
<tr>
<th>DIFFERENCE BETWEEN SCORES</th>
<th>ABSOLUTE FREQUENCY</th>
<th>RELATIVE FREQUENCY (PERCENT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>11.1</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>16.2</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>11.1</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>11.1</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>8.1</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>12.1</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>10.1</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Mean (4.88) and median (4.36) scores were within close proximity of each other. The mode of 2.0 was employed as the point of determination of scores to be used in later statistical analysis. These measures of central tendency indicated little difference between the two most dominant learning style scores.

Two measures of dispersion were determined. The range of scores was 1 to 14, with a standard deviation of 3.17. This distribution of scores is compatible with research results reported by Gregorc (1984).

All scores were used in conjunction with the statistical analyses conducted with one exception - the Chi Square analyses employed in response to Question 5. For Question 5, only those scores with differences of more than three (3) points between the top two dominant scores were used in the analysis, resulting in a deletion of twenty-nine (29) student scores from the analyses.

Question 1

Question 1 addressed the mediation abilities (teaching styles) of grade 12 English teachers in the Narragansett Regional School District. Table 5 summarizes the teachers' scores.
Table 5 reveals the dominant scores for each teacher. Two teachers appear to be Concrete Sequential (CS) dominance; one teacher appears to be Concrete Random (CR) dominance; and one teacher appears to be Abstract Random (AR) dominance. The highest mean score for the teachers was AR dominance (28); the lowest was CR dominance (22). The widest range of scores for the four teachers was CR (24-14); the most narrow was AS (29-23).

Only the AR mean score is indicative of review, according to interpretation information provided by Gregorc (1962). Scores, such as the AR dominance score of 28, which lie between 27 and 40 are indicative powerful mediation qualities. Seven individual scores reflected "pointy-head" dominance within the powerful range. Two scores (one female and one male) were strong CS; two scores (both male)
were strong AS; two scores (both male) were strong AR; and one score (female) was strong CR dominance. No mean scores averaged within the "short, stubby-point" range (10-15), which is indicative of extremely low mediation abilities. Only one individual score (14) was located in the short range, indicative of the male's least powerful mediation ability being in the CR range. The subject with the "short, stubby-point" score would be expected to have difficulty communicating and working with CR students. The remaining individual and mean scores, located within the 16 - 26 range, indicate moderate mediation abilities. Such moderate abilities allow the individual to participate in activities contained through these mediation channels with few problems.

Question 2

Question 2 examined the mediation abilities (learning styles) of grade 12 students at Narragansett Regional High School. Each of ninety-nine (99) students completed the Gregorc Delineator, as directed by the researcher. The subjects each received four (4) scores: Concrete Sequential, Abstract Sequential, Abstract Random, and Concrete Random. Each score corresponded to a particular learning style. Table 6 contains results of frequency distributions regarding the four learning styles examined.
Table 6 reveals Abstract Random (AR) to be the most dominant of the four learning styles among the ninety-nine (99) students surveyed (X = 27.05); Abstract Sequential (AS) as the least dominant (X = 23.26). Median and mode scores reflect a similar pattern. The range of all four learning styles is similar, as are the standard deviations of three of the four learning styles. Only AS deviates a bit, with a slightly narrower standard deviation (S.D. = 4.15) than the others. Mean and median scores, with the exception of AR, were within the moderate range of scores. However, the AR median and mean scores were both within the "pointy-head" range, indicative of a powerful learning style. Given the mode of 34 for AF, the results were appropriate for the sample. Although the mode was unusually high, the mean and median scores for AR were not surprisingly powerful.
The greatest range of scores was in Concrete Random (CR) (37-13). AS demonstrated the narrowest range of scores (34-15). Given the sample size, a range of scores from "short, stubby-point" to "pointy-head" was expected.

Question 3

Question 3 asked, "Is there a positive correlation between the degree to which students' and teachers' learning styles match, and the students' achievement in English?"
The District grades students using a letter scale. Letter grades, for the purposes of the study, were converted into numerical grades as follows: A=5; B=4; C=3; D=2; and E=1. The four (4) English teachers involved in the study provided grades to all ninety-nine (99) students. No incomplete grades were given for the term. The mean grade score was 3.35. Table 7 provides information regarding the distribution of the students' grades for term #1. Four (4) categories addressed in the table includes grades and conversions, as stated above, absolute frequencies, and relative frequencies. The relative frequencies are provided in the form of percentages. Totals are also provided.
Table 7 reveals that the majority of academic grades for students in the sample were located between "C" and "D" (58.6%). The fewest grades given were in the "A" category (5 grades; 5.1% of the total). An above-average number of failing grades of "E" (17 grades; 17.2% cumulative) was given. The mean and median grades were closely related (3.35, 3.41), and, as expected, located within the "C" range. A mode of 2.0 was lower than expected. The standard deviation (S.D. = 1.13) was narrow, yet it met predictions of the researcher.

Students whose dominant learning styles did not match those of their English teachers were then categorized as "Group 1". Students with a dominant learning style which matched that of their English teachers were categorized as
"Group 2". Of the ninety-nine (99) subjects in the sample, sixty-five (65) did not match while thirty-four (34) matched. Frequency information is presented in Table 8.

**TABLE 8**

Frequency distribution indicating students whose learning style matched or did not match the style of their English teachers

<table>
<thead>
<tr>
<th>CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (FCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Match</td>
<td>65</td>
<td>65.7</td>
</tr>
<tr>
<td>Match</td>
<td>34</td>
<td>34.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99</td>
<td>100.0</td>
</tr>
</tbody>
</table>

A t-test and pearson correlation coefficient were used to determine the degree to which teacher teaching style/student learning style matches and achievement in English were related. The results of the t-test are summarized in Table 9.

**TABLE 9**

A comparison of academic achievement of students whose styles matched that of their English teachers with those who had no match

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NUMBER OF CASES</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH GRADE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROUP #1 (Match)</td>
<td>34</td>
<td>4.09</td>
<td>.87</td>
<td>5.30*</td>
</tr>
<tr>
<td>GROUP #2 (No Match)</td>
<td>65</td>
<td>2.97</td>
<td>1.06</td>
<td></td>
</tr>
</tbody>
</table>

continued, next page
The t-test was significant at $p<.05$.

The t-test of 5.50 involved ninety-seven (97) degrees of freedom and was significant at $p<.05$ (two-tailed test). English grades for Group #1 (Match) were higher than for Group #2 (No Match) for the students sampled.

Calculation of the pearson correlation coefficient yielded an $r=0.47$, which was significant at the $p<.05$ level. The significant difference obtained was related to grades earned by the two sets of students. That is, grades for those students whose learning styles do not match the styles of their teachers are lower than grades for students whose learning styles match those of their English teachers. The mean English score for students in Group #1 (Match) was considerably higher than the mean English grade of students in Group #2 (No Match). Standard deviations for both groups were narrow, but the standard deviation for Group #2 was smaller than that of Group #1.

Question 4

Question 4 addressed the relationship between attendance and compatibility of teacher and student learning style. Table 10 includes information regarding absences for the term.
Table 10 reveals that more than fifty (50) per cent of the students were absent for two or fewer days during the forty-five (45) day academic term. The greatest number of absences was two (2) days (Mode = 2), while the least number of absences resulted at the higher end of the scale (10 and 11 days). The mean number of absences was 3.36 days; the median was 2. Absences ranged from 0 to 11 days, with a
standard deviation of 2.78. A moderate number of students (14) accounted for zero absences during the term.

Data reported in Table 10 were subjected to a t-test of statistical significance and to a coefficient of correlation. Results of the t-test are cited in Table 11.

**TABLE 11**

A comparison of number of absences of students whose learning styles matched that of their English teacher with those whose style did not

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NUMBER OF CASES</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP #1 (No Match)</td>
<td>65</td>
<td>3.97</td>
<td>2.77</td>
<td>3.12*</td>
</tr>
<tr>
<td>GROUP #2 (Match)</td>
<td>34</td>
<td>2.21</td>
<td>2.46</td>
<td></td>
</tr>
</tbody>
</table>

* t significant at p<.05.

The t-test of 3.12 involved ninety-seven (97) degrees of freedom and was significant at the p<.05 level (two-tailed test). The pearson correlation coefficient yielded an r=-.30, which was significant at the .05 level.

The mean absences for students in Group #1 (No match) was significantly greater (3.97) than for students in Group #2 (Match) (2.21). Standard deviations for both groups were narrow. The significance of the two analyses indicates a relationship between absenteeism and learning style match. Those students whose learning styles matched that of their English teacher were absent fewer times during the term than those who did not match.
Question 5

Teachers were asked to predict the individual learning styles of their students upon completion of a workshop on Learning Styles. Results of the predictions are included in Table 12.

**TABLE 12**

Predictions of English teachers regarding student learning styles

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CODE</th>
<th>ABSOLUTE FREQUENCY</th>
<th>RELATIVE FREQUENCY (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE SEQUENTIAL</td>
<td>1</td>
<td>29</td>
<td>29.3</td>
</tr>
<tr>
<td>ABSTRACT SEQUENTIAL</td>
<td>2</td>
<td>14</td>
<td>14.1</td>
</tr>
<tr>
<td>ABSTRACT RANDOM</td>
<td>3</td>
<td>31</td>
<td>31.3</td>
</tr>
<tr>
<td>CONCRETE RANDOM</td>
<td>4</td>
<td>25</td>
<td>25.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>99</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**MEAN = 2.53**  
**MODE = 3**  
**STD DEV = 1.16**

Table 12 reveals teacher predictions for student learning styles. Predictions for Abstract Random (AR) were the greatest frequency (31). The least predicted learning style was Abstract Sequential (AS) (14). With the exception of the low number of predictions for AS, the
remaining three categories each received a fairly equal number of predictions.

A Chi Square test was used to ascertain the strength of agreement of teachers' predictions. Only differences of three (3) or more points between the highest two (2) dominant scores (see Table 4) are examined. Results of the analysis are summarized in Table 13.

TABLE 13

A comparison of teacher predictions of student learning style with strength of agreement

<table>
<thead>
<tr>
<th>COUNT</th>
<th>STRENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROW PCT</td>
<td>COL PCT</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PRED 1</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>45.0</td>
</tr>
<tr>
<td></td>
<td>52.9</td>
</tr>
<tr>
<td></td>
<td>12.7</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>5.6</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>4.2</td>
</tr>
<tr>
<td>COLUMN TOTAL</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>23.9</td>
</tr>
</tbody>
</table>

95
A Chi Square of 17.49 was significant at the \( p < 0.05 \) level. However, the significance score of 0.04 obtained was not strong, as reflected by a Cramer's V of 0.29. Given that a Cramer's V only includes values between zero and one, the low Cramer's V would appear to indicate that although teachers were able to predict the learning styles of their students, the ability was not extensive.

**Question 6**

Question 6 addressed whether or not a relationship existed between length of acquaintance of the teacher with the student and his/her ability to predict learning styles. Table 14 portrays the length of time teachers worked with and/or knew the students. Teachers were asked to select a number between one (1) and four (4) to indicate the length of time he/she had known each student. No teacher selected four (4) years so the number four (4) option was dropped from calculations.
TABLE 14

Distribution of acquaintance of teachers with students in years

<table>
<thead>
<tr>
<th>CODE</th>
<th>ABSOLUTE FREQUENCY</th>
<th>RELATIVE FREQUENCY (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>39</td>
<td>39.4</td>
</tr>
<tr>
<td>2 years</td>
<td>52</td>
<td>52.5</td>
</tr>
<tr>
<td>3 years</td>
<td>8</td>
<td>8.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Most English teachers had been acquainted with fifty-two (52) students for two (2) years (Mode 2). The least number of years of acquaintance was three (3), with only eight (8) students fitting this category. A standard deviation of .62 was obtained for the small number of categories. The mean (1.69) and median (1.70) were nearly equivalent and within the anticipated range.

A Chi Square test was conducted to ascertain the significance of the distribution of acquaintance of teachers with students. Table 15 summarizes the results.
### Table 15

**Relationships between teachers' length of acquaintance of students and ability to predict learning styles**

<table>
<thead>
<tr>
<th>YEARS OF ACQUAINTANCE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREDICTION MATCH</td>
<td>18</td>
<td>30</td>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>34.0</td>
<td>56.6</td>
<td>9.4</td>
<td>53.5</td>
</tr>
<tr>
<td></td>
<td>46.2</td>
<td>57.7</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18.2</td>
<td>30.3</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>PREDICTION NON-MATCH</td>
<td>21</td>
<td>22</td>
<td>3</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>45.7</td>
<td>47.3</td>
<td>6.5</td>
<td>46.5</td>
</tr>
<tr>
<td></td>
<td>53.8</td>
<td>42.3</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21.2</td>
<td>22.2</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>COLUMN TOTAL</td>
<td>39</td>
<td>52</td>
<td>8</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>39.4</td>
<td>52.5</td>
<td>8.1</td>
<td>100.0</td>
</tr>
</tbody>
</table>

A Chi Square of 1.47 was not significant at the P<.05 level. A Cramer's V of .12 indicated very little relationship. Based upon the analyses, there was no significant relationship between the number of years of acquaintance of students and teachers with respect to whether or not the English teachers' predictions matched the actual learning styles of the students in the sample. Teachers who had known students for a lengthy period of time were not able to predict students' styles any better than for those for whom the length of acquaintance was one (1) year.
QUESTION 7

Question 7 offered a comparison of males/females with achievement. Both a t-test and a pearson coefficient of correlation were carried out. Results of the t-test are cited in Table 16. The pearson correlation was r = .24, which was significant at the .05 level.

**TABLE 16**

Comparison of sex of student versus achievement

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NUMBER OF CASES</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>50</td>
<td>3.62</td>
<td>.97</td>
<td>2.43*</td>
</tr>
<tr>
<td>Males</td>
<td>49</td>
<td>3.08</td>
<td>1.22</td>
<td></td>
</tr>
</tbody>
</table>

*t significant at p < .05.

The t-test of 2.43 involved ninety-seven (97) degrees of freedom and was significant at the p < .05 level (two-tailed test). A pearson correlation coefficient yielded an r = .24, which was significant at the .05 level. The significant t-test and correlation results suggest a relationship exists between the sex of a student and English achievement. Females appear to be the beneficiary of higher grades.
The final question to be explored in the study asked, "Is there a predominance of students favoring English (including grammar, literature and composition) class and the matching of student and teacher style. The frequency distributions are provided in Table 17. Students were requested to code responses on a Likert scale to indicate the extent to which each enjoyed English class during the present year. A number "1" indicated a complete dislike, while a "5" indicated a great enjoyment.

**TABLE 17**

Degree of student appreciation of English class during the present year

<table>
<thead>
<tr>
<th>CODE</th>
<th>ABSOLUTE FREQUENCY</th>
<th>RELATIVE FREQUENCY (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>11.1</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>19.2</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>18.2</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>34.3</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>17.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**MEAN:** 3.27 **MEDIAN:** 3.54

**MODE:** 4 **STD. DEV.:** 1.27 **RANGE:** 5-1

The mean appreciation level of students for English during the present year was 3.27. A median of 3.54 was
also computed. The mode of 4 was higher than both the mean and median. The range of student enjoyment was 1 to 5 with a standard deviation of 1.27. The fewest number of students (11) selected an appreciation level of 1. The majority of students appeared to like English during the present year, as 51.5% of the students rated English with a 4 or 5.

A Chi Square test was conducted to ascertain the significance of the appreciation of English class with matching/mismatching of teacher teaching style/student learning style. Table 18 summarizes the results.

<table>
<thead>
<tr>
<th>COUNT</th>
<th>LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>NO MATCH</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>11.1</td>
</tr>
<tr>
<td>MATCH</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>COLUMN TOTAL</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>11.1</td>
</tr>
</tbody>
</table>

The Chi Square of 38.71 was significant and a further analysis, calculating a Cramer's V = .63, supported the
strength of the Chi Square. The researcher expected the Cramer's V to be higher; however, given the significance of the Chi Square. The significant correlations indicate that students whose learning style matched the style of their English teachers liked English during the present year to a greater degree than students for whom there was no matched style. No student whose style matched that of his/her English teacher indicated a great dislike (score of 1) for English, while eleven (11) students whose styles did not match indicated a dislike of 1. Similarly, students whose styles matched the styles of their English teachers liked English with a score of 5 (15 students) to a greater extent than students whose styles did not match (2 students). Few students whose styles matched that of their English teachers rated English with an average liking or lower (4 students total).

Summary of the Results

The researcher sought to examine four learning style relationships in the study. Four (4) relationships were addressed in the study: the degree to which matched and mismatched student/teacher styles were related to English achievement; school attendance and compatibility of teacher and student styles; teacher ability to predict student styles with relation to length of acquaintance; and, whether a relationship existed between student sex and achieve-
ment. Table 19 summarizes results of analyses of the eight (8) questions addressed in the study.
### TABLE 19
Summary of data and analyses of questions addressed in study

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>DATA SOURCES</th>
<th>ANALYSES</th>
<th>IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher scores from Gregorc's Style Delineator</td>
<td>Mean, range</td>
<td>Two teachers were CS; one AR; AF mean dominance was highest (29); one teacher was CR; CR mean dominance was lowest (22); widest range was CR (24-14); narrowest range was AS (29-23); most scores at moderate range.</td>
</tr>
<tr>
<td>2</td>
<td>Students' scores from Gregorc's Style Delineator</td>
<td>Difference between top two dominant scores, mean, median, mode, standard deviation, range</td>
<td>AR mean was most dominant; AS least dominant; S.D. and ranges similar; AS slightly narrower S.D.; AR mean and median located in &quot;pointy-head&quot; range; high AR mode; CR had greatest range of scores.</td>
</tr>
</tbody>
</table>

continued, next page
<table>
<thead>
<tr>
<th></th>
<th>Students' and teachers' matched and mismatched scores from Gregorc Style Delineator; students' term #1 English grades</th>
<th>Mean, median, mode, range, standard deviation, t-test, Pearson correlation coefficient</th>
<th>Mean grade in average range; low mode; 34 styles matched; 65 styles mismatched; t-test significant at p&lt;.05; r=.47, significant at p&lt;.05.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Students' and teachers' matched and mismatched scores from Gregorc Style Delineator; students' term #1 attendance</td>
<td>Mean, range, mode, standard deviation, t-test, Pearson correlation coefficient</td>
<td>Low mean absences; average absence range; moderate number of students with zero absences; t-test significant at p&lt;.05; r=.30, significant at p&lt;.05.</td>
</tr>
<tr>
<td>4</td>
<td>Teachers' predictions of student learning styles</td>
<td>Mean, mode, standard deviation, Chi Square, Cramer's V</td>
<td>Predicted most students were AR; fewest students were AS; Chi Square significant at p&lt;.05; Cramer's V significance high.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>continued, next page</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teachers' predictions of student learning styles; length of acquaintance of teachers for students</td>
<td>Mean, median, mode, range, standard deviation; Chi Square; Cramer's V</td>
<td>Greatest acquaintance was 2 years; least acquaintance was 3 years; Chi Square significant at p&lt;.05; low Cramer's V.</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Students' term #1 English grades; list of male and female students</td>
<td>t-test, pearson correlation coefficient</td>
<td>t-test and pearson were significant at p&lt;.05; minimal differences between means and standard deviations.</td>
</tr>
<tr>
<td>8</td>
<td>Students' Likert scales for favoring English; students' and teachers' matched and mismatched scores from Gregorc Style Delineator</td>
<td>Mean, median, mode, range, standard deviation, Chi Square; Cramer's V</td>
<td>Average mean appreciation level; Chi Square significant at p&lt;.05; high Cramer's V.</td>
</tr>
</tbody>
</table>
The results indicated that: (1) a significant relationship existed between those students whose learning style matched the teaching style of their English teachers and the degree to which the students enjoyed English; (2) there was a significant relationship between the learning style/teaching style of students/teachers and the students' attendance patterns; (3) the correlation between the sex of the student and his/her academic achievement was significant; (4) teachers in the study predicted the individual learning styles with low accuracy; (5) a significant relationship existed when comparing the learning styles of students who were compatible with the teaching styles of their English teachers and school attendance; and (6) the relationship between the length of acquaintance of the teacher with the student and his/her ability to predict learning styles was not significant.
Chapter V addresses implications of the results obtained in response to each study question. Each relationship outlined previously and its analyses are summarized. After a brief study summary, four important relationships are discussed. Possible sources of error apt to impact upon the results are taken into account. Implications based upon results reported are examined. Finally, recommendations for further investigation are offered.

Study Summary

The study examined the relationship between student learning style/teacher teaching style and attendance and academic achievement of students in their senior year in a rural comprehensive high school. Teachers were asked to predict the learning styles of their students and relationships were drawn comparing student/teacher style match/mismatch with predictions. The predominance of students favoring English class and compatibility of student/teacher style were examined. Length of acquaintance of teacher and student were related to ability to predict student learning style. Comparisons were examined with relation to sex of students and academic achievement.
All subjects completed the Gregorc Delineator, which assesses four specific learning styles. Significant relationships existed between matched learning style/teaching style and achievement as well as school attendance. Significant relationships also existed with respect to ability to predict learning style by teachers and students favoring English class when styles were matched. A significant relation was determined to exist between sex of student and academic achievement. Little relationship existed between length of acquaintance and ability to predict learning styles.

Discussion

Relationship I

Relationship I examined academic performance of students with respect to learning/teaching style match/mismatch with that of the English teacher. Several previous studies determined that a match of teacher teaching style and student learning style resulted in better academic achievement (Dunn and Dunn, 1981, 1987; Butler, 1982; McCarthy, 1989). Results of this study suggested that such a relationship did exist for the sample and school studied.

All four senior English teachers completed the Gregorc Style Delineator, following a workshop on learning and teaching styles. Mean scores for the subjects was somewhat equally divided, with all means in the range of 22 to 28.
According to Gregorc, scores higher than thirty (30) and lower than fifteen (15) require further analysis, as individuals in the extremely high and extremely low areas are considered "pointy-heads", or having strong learning styles. Since only four teachers were involved in the study, specific analyses would have been inconclusive. However, no teacher displayed a dominant learning style of Abstract Sequential. Two were Concrete Sequential and of the remaining two teachers, one was Abstract Random and the other Concrete Random.

As with the population of English teachers, student learning style means exhibited normal ranges, between 23.26 and 27.05. Ninety-nine (99) students completed the Gregorc Delineator. The mean academic grade for term 1 for the subjects involved in the study was 3.35, approximately a C average. Matches of student/teacher learning styles were determined. While thirty-four (34) students' styles matched those of their teachers, sixty-five (65) did not. The mean scores differed considerably. The mean score for those students whose style matched that of their teacher was 4.09 in contrast to the mean for those whose style did not match, which was 2.97. The two (2) groups' mean scores differed significantly at the .05 level. The significance indicated that students whose style matched that of their English teacher performed better academically than those whose style did not match, for the population examined. Grades for students without a learning style match were
much lower. The employment of the Pearson correlation coefficient results supported the t-test outcomes.

Relationship II

A review of the literature, in Chapter II, indicated that few learning styles studies have examined the relationship of compatibility of student and teacher learning styles with respect to school attendance. Students in New York, who were constant truants, were selected to participate in a study designed to examine learning style matches and attendance. The students' learning styles were identified, using the Dunn LSI, and each was assigned to a new school, based entirely upon learning styles. According to Dunn (1985), student attendance, in addition to other factors, improved significantly. Although other factors may indeed influence the students' school attendance, such as the Narragansett School Attendance Policy and other subject areas being favored by the students, the present study identified a significant relationship at the .05 level between the factors of learning/teaching style match and attendance. Absences for Group I, those without a learning style match, were higher than the absences of students whose styles matched that of their English teachers. The means were 3.97 (Group I) versus 2.21 (Group II). The t-test was significant at the .05 level. The Pearson correlation coefficient of -.30 was also significant. These analyses suggested that students without a matching learn-
ing style were absent more frequently than those whose style matched.

Relationship III

The ability of teachers to predict the learning styles of each student enrolled in their classes was the focus of the third relationship. The teachers indicated that they believed the fewest number of students were Abstract Sequential. A frequent comment of teachers involved in the study was that they had difficulty understanding the difference between an Abstract Sequential and an Abstract Random. Predictions among teachers for the three remaining learning styles were somewhat evenly divided, with Abstract Random predictions being listed most frequently. A chi square analysis was significant at the p<.05 level. The Cramer's V reinforced the contention that teachers could, with a reasonable degree of accuracy, predict the learning styles of their students.

In order to determine whether or not the length of acquaintance of the teacher and student was related to the ability to predict learning styles, a chi square was employed. Although the school houses students in grades seven through twelve and the possibility existed that teachers could have been acquainted with individual students through sports or other academic classes for a period of five years, this was not the case. Most students had been acquainted with the teachers for two (2) years, as indicated by a mean of 1.68 and a mode of 2 years. Surprisingly, the chi
square was not significant and the Cramer’s V indicated a very low relationship. The period of time with which a teacher and student have been acquainted with each other, for the present sample, had no effect upon the ability of the educator to predict the student’s style. Teachers had not previously participated in any workshops or courses related to learning styles. Thus, all teachers involved in the present study, had completed only the one learning styles workshop, which was provided to them one week before the data collection began. Since each began from the commonality of the same workshop, the acquaintance period would have had little relationship with the ability to predict the style of the individual students, for prior to the study, the teachers did not look at issues affecting student style. It should be noted that 46.5% of the predictions did not match, while only 53.5% of the predictions were accurate. Although there was no significance, it did appear, from the data, that where the predictions matched, the longer the period of acquaintance between student and teacher, the better the match. The percentages for matched predictions were: 46.2% (1 year), 57.7% (2 years), and 62.5% (3 years). The percentages for non-matched predictions decreased proportionally, but the percentages for all data were not within significant levels.
The present sample included forty-nine (49) males and fifty (50) females. The correlation between sex of the students and achievement was addressed in Question 7. A significant difference resulted through statistical analysis. Mean scores were 3.08 for males and 3.62 for females. The significance was 2.43, based upon 97 degrees of freedom, using a pooled variance estimate. A review of the data indicates that the majority of males were Concrete Random, while females tended to be Abstract Random. Based upon an awareness of those students who participate in entire events, such as school dance preparation, the majority tend to be females. Such participation is typical, according to Gregorc (1982), for Abstract Random individuals.

In order to comprehend the predominance of students favoring English class and whether or not student and teacher styles were matched required the employment of a chi square test. Students were requested to indicate how much each enjoyed English class during the present year. The question was arranged in a Likert scale, with a number range of 1 to 5. "1" indicated a strong dislike, and "5" indicated a strong liking. The mean score was 3.27. However, a score of "4" was most prevalent. Application of the chi square test indicated a significance at the .05 level, which was supported by a Cramer's V of .63.

Where the students' learning styles did not match that of their English teachers, only two students indicated that
they strongly enjoyed English. For those students whose learning styles matched that of their English teachers, no students indicated a strong dislike of English and only one student preferred a "2". The data suggests that, for the population studied, students, who have a matching learning style to that of their English teacher, enjoy English classes to a greater degree. Conversely, students' dislike of English during the present year may be related to the fact that their learning styles do not flex easily to meet the teaching style of their English teachers.

Implications of the Study

Certainly the strongest result of the study involves the subjects. Teachers and students alike have become more cognizant of learning styles and its involvement with education. All teachers participated in the October workshop involving learning styles. Following the meeting, several approached the Curriculum Coordinator to request additional workshops and information on the topic of learning styles. As a result, twenty-seven (27) staff participated in a continuation workshop on learning styles in March. This involved one-third of the staff. Teachers have requested a three-credit in-service course on learning and teaching styles for the coming year. Students, although not as strongly desirous of additional workshops on the topic, have requested additional information regarding their spe-
cific styles as determined by the Style Delineator. Several have indicated that the results may be helpful to them in college in the selection of professors and classes.

The results of the study were beyond expectations. Students with matching learning styles to those of their English teachers performed better in English and also came to school more frequently than those seniors whose styles did not match. Teachers were able to predict the styles of students enrolled in their classes, but the amount of time the teachers and students had been acquainted had no effect on the quality of the prediction. Whether or not a student was a male or female did affect the quality of the academic report in English for the term. Students who enjoyed English were more likely to have a matching learning style to that of their English teachers than those who did not.

The Gregorc Delineator was selected as the learning styles assessment instrument for this study, because it impacted class time to a lesser extent than other instruments. The students and teachers immediately were informed of the results. The administration period for the Delineator, including introduction, administration, and discussion, involved one (1) class period. To employ a longer instrument, such as the NASSP model or the Dunn LSI, although each provides considerably more data, would present additional time consumption and delay of information to the students. Each of the two (2) previous instruments calls for computer analysis, which requires a time delay, due to
the requirement that student response sheets be mailed to either New York or Virginia for processing. The Gregorc Style Delineator provided immediate feedback to each student, a sound educational practice.

As anticipated, achievement in English was related to learning style/teaching style matches. Additionally, student attendance was better for those students whose styles matched those of their teachers of English. Finally, students who liked English generally were those whose learning style matched the style of their English teacher. Yet, although the information provided strong impetus for teachers to adapt their classrooms and teaching styles to meet the needs of those students whose styles did not match that of their teachers, little has occurred. Although teachers strongly agreed with the findings and implications, few were able to adapt immediately. Based upon Dunn (1988), a learning styles classroom or school requires administrative and guidance department support in order to prove successful. Classrooms can be adapted easily without heavy financial expense. Yet, with the implications of the study for the Narragansett Regional School District population and the desire of staff members to more fully comprehend and deal with learning styles, the future appears brighter than prior to the study's commencement.

The significance of the correlation between sex of the student and achievement was surprising. English courses provide opportunities for students at all ordering and per-
ception ability levels to create something according to their preferences, whether it is a composition, play, multiple choice examination or listening to a video or tape. Given the wide selection of activities in senior English classes, males and females would be expected to perform equally well. Had the study been conducted in a different academic area, such as home economics, perhaps differences would have been more prevalent, since home economics requires more hands-on types of activities than English, for which females, who according to Witkin (1945) are more field dependent or Abstract Random (Gregorc, 1982).

Analysis of data indicated that English teachers were able to predict the learning styles of their students with reasonable accuracy, as expected. However, a perplexing aspect involved the second portion of the study which addressed the extent to which years of acquaintance with the students influenced ability to predict learning style. Upon review of the raw data, some teachers' predictions were better as the length of acquaintance increased. Yet, the frequency of occurrence did not affect the final results to any extent, since results were not significant at p<.05.

Although the results of the study appear to support the work of previous researchers (Dunn and Dunn, 1985; Gregorc, 1982), much more work appears required. Based upon the results obtained in the study, it would appear that learning styles theory requires further analysis and study.
Learning styles research holds promise as a means of improving education for all students.

Sources of Error

Based upon the determinations made in the study, several possible sources of error need to be considered. As stated previously, in Chapter III, the small number of students and, especially teachers, involved in the study could have restricted the results of the study. Students and teachers at Narragansett Regional High School may or may not be like students and teachers in other schools throughout the United States.

A major source of possible error resulted when the researcher provided students with definitions for each word in the Delineator. Yet, without the definition sheet, found in Appendix C, the study could not have continued, as only students in the Advanced Placement classes (2 groups of nine (9) students) understood the words. Provision of definitions allowed students to connote different meanings for the words presented, which, according to Gregorc were selected after much study in order to elicit specific feelings from the subjects.

The fact that grades and absences were taken from the first term could have also interfered with the results. Students had been in school with the specific instructor for only forty-five (45) days. Perhaps neither the teacher
nor the students had had enough time in which to comprehend each other's learning/teaching styles. Additionally, although attendance for those students whose styles matched those of their English teachers was significantly better than for those students whose styles did not match, the reason for school attendance may not be entirely attributed to learning styles match. Many students may have attended school as a result of the Narragansett Regional High School attendance policy, where absences are constantly monitored and either labeled as "excused" or "unexcused". Upon several unexcused absences, students are assigned to an in-house suspension room, which most dislike. Thus, students often arrive at school merely to avoid assignment to the ISS room. Another possible aspect could involve the fact that students attend school in order to attend classes which they also enjoy, for instance, physical education, ceramics, and various school activities. To separate such possible sources of error was not attempted in the present study, nor would it have been easily accomplished, given the type of school involved in the study.

Suggestions for Further Investigation

As a result of the information gained through the study, the following listing of recommendations for further study is presented for future researchers. Given the fact that little research has been compiled involving school at-
tendance with relation to learning styles, the study could be replicated in a number of different ways. Students and teachers from several school systems could serve as the sample, thus enlarging the sample base. A private school setting might also serve as a sample base. Given the difficulty of many seniors in comprehending the words employed in the Delineator, the study might be replicated at the community or four-year college level, with older students. In the process of assessing older students, specific university or college departments might be examined to compare students enrolled in courses in the English department versus students taking a course to complete a college requirement.

For the high school student body, a different instrument might be employed, such as the Dunn LSI. Since only one assessment using the LSI has examined attendance, the LSI could be employed with the same populations explained in the previous paragraph.

A different instrument, such as the Dunn LSI, might be used in conjunction with the Gregorc Delineator with high school students. Gifted and Talented students might be compared with Special Needs students, with relation to attendance and achievement. Other factors which might be examined while using two separate instruments might include participation in outside activities with respect to learning styles. In other words, one might compare the learn-
ing styles of students who participate in debate clubs, foreign language clubs, and sports.

Rather than examine four (4) learning styles, future research might center upon one specific learning style, such as Concrete Random, and the effects of the school environment on a subject, such as social studies. The four (4) styles might also be examined with other academic areas, such as physical education or foreign languages.

A researcher might wish to examine academic grades and attendance over the period of one school year for their relation to matched and mismatched learning and teaching styles. Each term could be reported and compared. Then, the final grades and attendance could be analyzed for differences and changes over the longer time span. A longer study, which could produce some interesting results, could be accomplished by following a specific group of students and their learning styles commencing with their senior year in high school and continuing through to the age of twenty-one (21). Research could analyze trends identified through learning style match/mismatch and future life choices.
APPENDIX A

LETTER
Dear Parents,

The most important factor we have in common is our concern for the children of our school district. We all want them to succeed in school and learn information which will be helpful to them in their jobs or in college.

In order to work toward better ways to help students in their school and schoolwork, I would like to ask your help. I would like to survey each senior at Narragansett this fall, using a form which was developed by Anthony Gregorc, a professor in learning styles from the University of Connecticut. The survey takes between three and five minutes to complete. I have included a sample question on the next page for you to review.

I will place the answers from the survey into a computer to determine results, which hopefully, will be useful to our school and its students. The results should also be helpful to seniors immediately for them to use.

No names of individual students will be used in any type of report. The results of individual students will not be given to anyone other than the student himself/herself. The survey is intended to determine each student's particular learning style. Learning styles affect school and job performance, and we know that if a student knows his/her particular learning style, he/she can do better in school, college, and on the job.

I have already discussed this survey with the School Committee, Superintendent, and Principal prior to writing to you. Hopefully, you will allow your son/daughter to participate in this very important survey. If you have any questions, please contact me at 939-5388 (my office) or 297-0329 (my home) and I will be happy to answer them. Please return the bottom portion of the next page with your signature ONLY IF YOU DO NOT WISH TO HAVE YOUR CHILD PARTICIPATE and return to my mailbox in the Main Office by October 17th. Thank you.

Sincerely,

Coral May Grout
Curriculum Coordinator
THIS PORTION IS TO BE RETURNED TO SCHOOL ONLY IF YOU DO NOT WISH TO HAVE YOUR CHILD PARTICIPATE.

NAME OF CHILD: ______________________________________

I do not wish to have my child participate in the Learning Styles survey.

Parent's Signature: ______________________________________

Date: __________________________
APPENDIX B

DELINEATOR INFORMATION
The instrument selected for the purposes of the study was the Gregorc Delineator, introduced by Anthony Gregorc in 1985. Administration time is approximately five (5) minutes, and the instrument may be employed with groups or individually.

According to Gregorc (1985),

The Gregorc Style Delineator requires the individual to actively connect words with personal thoughts and feelings. The words are meant to prompt the individual to bring to life something that the Self sees/hears/experiences. The intensity of this activity is registered and acted upon by the ranking of the words in a 4-3-2-1 order. (p. 2)

Forty (40) words are arranged into ten (10) columns of four (4) words each. The words are "not parallel in construction nor are they all adjectives or all verbs." Gregorc (1985). The purpose, according to the researcher, is that the words have been selected to draw a reaction from the subject, for the word itself, rather than for the part of speech represented. The subject is requested to rank order each column from 1, for least descriptive of the subject, to 4, for most descriptive. Directions are included for adding the rows and graphing the results.

The Gregorc Style Delineator is available for a nominal cost through Gregorc Associates, Columbia, CT.
APPENDIX C
SYNONYM SHEET
These definitions are provided to help you in completing the Delineator of your learning style.

1a. **Objective:** Not biased, not partial, making decisions based upon facts

1b. **Evaluative:** Estimating, appraising, reviewing in order to rate

1c. **Sensitive:** Thin-skinned, one who reacts easily and cares about others

1d. **Intuitive:** Having the ability to act quickly without spending time to reason something out

2a. **Perfectionist:** One who completes everything he/she starts excellently

2b. **Research:** To examine, investigate, study

2c. **Colorful:** Liking colors

2d. **Risk-Taker:** One who takes chances

3a. **Solid:** Stable, firm, sturdy, preferring concrete activities

3b. **Quality:** Goodness, excellence, better characteristics

3c. **Non-Judgmental:** Not judging, offering no opinions, not making decisions

3d. **Insightful:** Having the ability to act without spending time to reason out the problem, perceptive
4a. Practical: Down-to-earth, preferring useful, orderly activities
4b. Rational: Sensible, thoughtful
4c. Lively: Active, full of life
4d. Perceptive: Understanding, able to act with reasoning, something out

5a. Careful with Detail: Paying attention to completing every part of an activity or problem, complete

5b. Ideas: Brainstorming, working with one's mind instead of with concrete things (things you can touch)

5c. Aware: Knowing what is going on around you
5d. Creative: Having much imagination, liking to invent

6a. Thorough: Following activities through to completion
6b. Logical: Fair, following activities through in an orderly way

6c. Spontaneous: Completing an activity without thinking about it ahead of time, doing something freely or naturally
6d. Trouble-Shooter: One who needs personal proof by finding a solution to a problem without the help of anyone else

7a. Realistic: Practical, seeing things as they really are
7b. Referential: Pointing out things to others, giving credit to someone who knows more about topics than oneself

7c. Empathy: Caring about the ideas or feelings of others

7d. Innovative: Coming up with new ideas, methods, devices

8a. Ordered: A place for everything and everything in its place

8b. Proof: Needing someone or something to prove that a something is true

8c. Attuned: Aware of what is going on or happening around oneself

8d. Multi-Solutions: Finding many solutions to problems, instead of only one
APPENDIX D

TEACHER PREDICTIONS
TABLE 20
Analysis of predictions for teacher #1

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS (1)</td>
<td>4</td>
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</tr>
<tr>
<td>AS (2)</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>AR (3)</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>CR (4)</td>
<td>5</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>100.0</td>
</tr>
</tbody>
</table>

MEAN: 2.67 STANDARD DEVIATION: 1.11

TABLE 21
Analysis of predictions for teacher #2

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS (1)</td>
<td>7</td>
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</tr>
<tr>
<td>AS (2)</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>AR (3)</td>
<td>6</td>
<td>27.3</td>
</tr>
<tr>
<td>CR (4)</td>
<td>8</td>
<td>36.4</td>
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<tr>
<td></td>
<td>22</td>
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</tr>
</tbody>
</table>

MEAN: 2.68 STANDARD DEVIATION: 1.26
### Table 22

Analysis of predictions for teacher #3

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS (1)</td>
<td>10</td>
<td>28.6</td>
</tr>
<tr>
<td>AS (2)</td>
<td>7</td>
<td>20.0</td>
</tr>
<tr>
<td>AP (3)</td>
<td>10</td>
<td>28.6</td>
</tr>
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<td>CR (4)</td>
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<td>22.8</td>
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</table>

**MEAN:** 2.46  **STANDARD DEVIATION:** 1.13

### Table 23

Analysis of predictions for teacher #4

<table>
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<th>CATEGORY</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS (1)</td>
<td>8</td>
<td>33.3</td>
</tr>
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<td>AS (2)</td>
<td>3</td>
<td>12.5</td>
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<td>AR (3)</td>
<td>8</td>
<td>33.3</td>
</tr>
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</table>

**MEAN:** 2.42  **STANDARD DEVIATION:** .93
APPENDIX E

FREQUENCY DISTRIBUTIONS
<table>
<thead>
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<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
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<tr>
<td>13</td>
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<tr>
<td>14</td>
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<tr>
<td>15</td>
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<tr>
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<tbody>
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MEAN: 23.76  
MODE: 23  
STD DEV: 5.79  
RANGE: 35-13  
MEDIAN: 23.33
### TABLE 25

**Frequency distribution of student abstract sequential scores**

<table>
<thead>
<tr>
<th>SCORE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1</td>
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</tr>
<tr>
<td>16</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td>4.0</td>
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<td>6.1</td>
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<td>3.0</td>
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<tr>
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<td>4.0</td>
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<td>3.0</td>
</tr>
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<td>1</td>
<td>1.0</td>
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<td>2</td>
<td>2.0</td>
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<tr>
<td>32</td>
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<td>3.0</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>34</td>
<td>1</td>
<td>1.0</td>
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<tr>
<td>TOTAL</td>
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<td>100.0</td>
</tr>
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</table>

*continued, next page*
### TABLE 25, continued

<p>| MEAN: 23.26 | MEDIAN: 23.19 |
| MODE: 22   | RANGE: 34-15  |
| STD DEV: 4.15 |            |</p>
<table>
<thead>
<tr>
<th>SCORE</th>
<th>ABSOLUTE FREQ.</th>
<th>relative FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
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<tr>
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<td>2</td>
<td>2.0</td>
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<tr>
<td>19</td>
<td>5</td>
<td>5.1</td>
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<td>25</td>
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<td>9.1</td>
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<td>3</td>
<td>3.0</td>
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<td>8.1</td>
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<td>9.1</td>
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<td>29</td>
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<td>6.1</td>
</tr>
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<td>2.0</td>
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</tr>
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<td>4.0</td>
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</tr>
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<td>MEAN</td>
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</tr>
<tr>
<td>MODE</td>
<td>34</td>
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</tr>
<tr>
<td>MEDIAN</td>
<td>27.19</td>
<td>RANGE: 37-15</td>
</tr>
</tbody>
</table>
TABLE 27

Frequency distribution of student concrete random scores

<table>
<thead>
<tr>
<th>SCORE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
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<td>1.0</td>
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<td>15</td>
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<td>1.0</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>5.1</td>
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<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>21</td>
<td>6</td>
<td>6.1</td>
</tr>
<tr>
<td>22</td>
<td>11</td>
<td>11.1</td>
</tr>
<tr>
<td>23</td>
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<td>5.1</td>
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<tr>
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<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>25</td>
<td>2</td>
<td>2.0</td>
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<td>26</td>
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<td>9.1</td>
</tr>
<tr>
<td>27</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>28</td>
<td>7</td>
<td>7.1</td>
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<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>30</td>
<td>9</td>
<td>9.1</td>
</tr>
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<td>31</td>
<td>7</td>
<td>7.1</td>
</tr>
<tr>
<td>32</td>
<td>7</td>
<td>7.1</td>
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<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>35</td>
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<td>3.0</td>
</tr>
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### TABLE 27, continued

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<tr>
<td>37</td>
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</tr>
<tr>
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</table>

**Mean:** 25.87  
**Mode:** 22  
**Std Dev:** 5.38  
**Median:** 26.22  
**Range:** 37-13
APPENDIX F

ANALYSES OF ENGLISH GRADES
### TABLE 28

Analysis of English grades for teacher #1

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>4</td>
<td>22.2</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>8</td>
<td>44.4</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>1</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Mean: 5.17  
Standard Deviation: 1.01

### TABLE 29

Analysis of English grades for teacher #2

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>7</td>
<td>31.8</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>7</td>
<td>31.8</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>6</td>
<td>27.4</td>
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<tr>
<td>D</td>
<td>2</td>
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<td>4.5</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>1</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Mean: 3.82  
Standard Deviation: 1.07
### TABLE 30

**Analysis of English grades for teacher #3**

<table>
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<th>CATEGORY</th>
<th>CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5</td>
<td>5</td>
<td>14.3</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>8</td>
<td>22.9</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>7</td>
<td>20.0</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>12</td>
<td>34.3</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>3</td>
<td>8.5</td>
</tr>
</tbody>
</table>

| TOTAL    |      | 35             | 100.0                |

**MEAN: 3.0**  **STANDARD DEVIATION: 1.2**

### TABLE 31

**Analysis of English grades for teacher #4**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>11</td>
<td>45.8</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>7</td>
<td>29.2</td>
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<td>12.5</td>
</tr>
<tr>
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</table>

| TOTAL    |      | 24             | 100.0                |

**MEAN: 3.58**  **STANDARD DEVIATION: 0.86**
TABLE 32

Frequency distribution of number of students per English teacher

<table>
<thead>
<tr>
<th>CATEGORY CODE</th>
<th>ABSOLUTE FREQ.</th>
<th>RELATIVE FREQ. (PCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEACHER 1</td>
<td>18</td>
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<tr>
<td>TEACHER 2</td>
<td>22</td>
<td>22.2</td>
</tr>
<tr>
<td>TEACHER 3</td>
<td>35</td>
<td>35.4</td>
</tr>
<tr>
<td>TEACHER 4</td>
<td>24</td>
<td>24.2</td>
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<tr>
<td></td>
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MEAN: 2.66  STANDARD DEVIATION: 1.04


Dunn, R. S. "Would You Like to Know Your Learning Style?" *Early Years.* 13. October, 1982, pp. 27-29, 70.


Dunn, R. S. and Dunn, K. "Learning Styles/Teaching Styles: Should They...Can They...Be Matched?" Educational Leadership 36. January, 1979, pp. 238-244.


Dunn, R. S. and Dunn, K. "Ten Ways to Make the Classroom a Better Place to Learn." Instructor. November-December, 1984, pp. 84-87, 139.

Dunn, R. S. and Dunn, K. "What Does the Research on Learning Styles Have to Do with Mario?" The Clearinghouse 59. 1985, pp. 9-12.


McCarthy, B. "What 4MAT Training Teaches Us About Staff Development." Educational Leadership 42. April, 1985, pp. 61-68.


